18 ATTACHMENT 11 - PROGRAM PREFERENCES

Table 18-1: Statewide Priorities for the IRWM Grant Program

Statewide Priorities:	Description:	Projects Consistent with Statewide Priorities:
Drought Preparedness	Proposals that contain projects that effectively address long-term drought preparedness by contributing to sustainable water supply and reliability during water shortages. Drought preparedness projects do not include drought emergency response actions, such as trucking of water or lowering well intakes. Desirable proposals will achieve one or more of the following: Promote water conservation, conjunctive use, reuse and recycling; Improve landscape and agricultural irrigation efficiencies; Achieve long term reduction of water use; Efficient groundwater basin management; or Establish system interties.	Plum Basin, Water Reuse Pipeline, Paregien Basin
Use and Reuse Water More Efficiently	Proposals that include projects that implement water use efficiency, water conservation, recycling and reuse to help meet future water demands, increase water supply reliability and adapt to climate change. Desirable proposals include those with projects that: Increase urban and agricultural water use efficiency measures such as conservation and recycling; Capture, store, treat, and use urban stormwater runoff (such as percolation to usable aquifers, underground storage beneath parks, small surface basins, domestic stormwater capture systems, or the creation of catch basins or sumps downhill of development) or projects outlined in PRC §30916 (SB 790); or Incorporate and implement low impact development (LID) design features, techniques, and practices to reduce or eliminate stormwater runoff.	Plum Basin, Water Reuse Pipeline, Paregien Basin
Climate Change Response Actions	Water Management actions that will address the key Climate Change issues of: Adaptation to Climate Change; Reduction of Greenhouse Gas (GHG) Emissions; and Reduce Energy Consumption. Proposals that contain projects that when implemented address adaptation to climate change effects in an IRWM region. Desirable proposals include those that: Advance and expand conjunctive management of multiple water supply sources; Use and reuse water more efficiently; Water management system modifications that address anticipated climate change impacts, such as rising sea-level, and which may include modifications or relocations of intakes or outfalls; or Establish migration corridors, re-establish river-floodplain hydrologic continuity, re-introduce anadromous fish populations to upper watersheds, and enhance and protect upper watershed forests and meadow systems. Proposals that contain projects that reduce GHG emissions compared to alternate projects that achieve similar water management contributions toward IRWM objectives. Desirable proposals include those that: Reduce energy consumption of water systems and uses; or Use cleaner energy sources to move and treat water. Proposals that contain projects that reduce not only water demand but wastewater loads as well, and can reduce energy demand and GHG emissions. Desirable proposals include: Water use efficiency, Water recycling, Water system energy efficiency, and Reuse runoff.	Water Reuse Pipeline, Plum Basin, Paregien Basin
Expand Environmental Stewardship	Proposals that contain projects that practice, promote, improve, and expand environmental stewardship to protect and enhance the environment by improving watersheds, floodplains, and instream functions and to sustain water and flood management ecosystems.	Oakes Basin, Paregien Basin, Plum Basin
Practice Integrated Flood Management	Proposals that contain projects that promote and practice integrated flood management to provide multiple benefits including: Better emergency preparedness and response; Improved flood protection; More sustainable flood and water management systems; Enhanced floodplain ecosystems; or LID techniques that store and infiltrate runoff while protecting groundwater.	Paregien Basin, Plum Basin, Oakes Basin
Protect Surface Water and Groundwater Quality	Proposals that include: Protecting and restoring surface water and groundwater quality to safeguard public and environmental health and secure water supplies for beneficial uses; or Salt/nutrient management planning as a component of an IRWM Plan	DAC Groundwater Quality Protection & Investigation
Improve Tribal Water and Natural Resources	Proposals that include the development of Tribal consultation, collaboration, and access to funding for water programs and projects to better sustain Tribal water and natural resources.	N/A
Ensure Equitable Districbution of Benefits	Proposals that: Increase the participation of small and disadvantaged communities in the IRWM process; Develop multi-benefit projects with consideration of affected disadvantaged communities and vulnerable populations; Contain projects that address safe drinking water and wastewater treatment needs of DACs; or Address critical water supply or water quality needs of California Native American Tribes within the region.	DAC Groundwater Quality Protection & Investigation, Paregien Basin

18.1 Plum Basin Project

The project is consistent with the following Program Preferences:

- Use of water more efficiently with significantly greater water conservation, recycling, and reuse to help meet future water demands and adapt to climate change (California Water Plan 2009);Implementation of conjunctive use management strategies;
- Reduction of groundwater overdraft (California Water Plan 2009);
- Effectively recharge and use aquifers as water banks (California Water Plan 2009);
- Regional projects or programs; and
- CAL-FED Bay-Delta Program objective of water supply reliability.

Regional Project or Programs

This basin project involves a water management and cost sharing program between two regional Kaweah River Basin IRWM members. This partnership between an irrigation district and a municipality will help to address regional water management issues through leveraging resources that would not have been available if the partnership did not exist. The project will recharge an average of 3,270 acre-feet per year that will make groundwater supplies more reliable in the Kaweah River Basin Region. Tulare ID will actively attempt to secure surplus water supplies from other regional partners for use in the project through water transfers and sales on behalf of and funded by the City of Tulare.

CAL-FED Bay-Delta Program Objective: Water Supply Reliability

As discussed in Attachment 3, the project will recharge an average of 3,270 acre-feet per year that will make groundwater supplies more reliable in the Kaweah River Basin Region. As this is new project, this is recharge capacity has historically not available to the region. Increasing the amount of groundwater recharge and the available groundwater recharge capacity is vital to the critically overdrafted Kaweah River Basin Region.

The project is also consistent with the following Statewide Priority:

- Drought Preparedness;
- Use and Reuse Water More Efficiently; and
- Climate Change Response Actions.

Drought Preparedness

Tulare ID's Plum Basin Project helps address drought preparedness within the District and the Kaweah River region by increasing water conservation potential, reducing long-term groundwater overdraft, increasing the reliability of groundwater resources that will be relied on by growers during drought times, and increasing the region's and the District's ability to efficiently manage the groundwater basin. This project will increase the amount of surface water intentionally recharged by the District and will thereby increase groundwater reliability.

Since Tulare ID does not have sufficient surface water supplies to deliver irrigation water to growers all year long, every grower in the District must have a private groundwater well. Surface water is seasonally available to Tulare ID growers, and groundwater is the only reliable source of water to the District. Therefore the District is a conjunctive use district (conjunctively using surface and groundwater resources) and this project will expand the District's conjunctive use efforts to be prepared for drought conditions through increased groundwater recharge. The increased groundwater supply would benefit irrigation districts and municipalities within the Kaweah River region not just during dry years, but also during years of reduced water allocations due to environmental concerns, as discussed in Attachment 7.

Use and Reuse Water More Efficiently

This statewide priority category includes projects that implement water use efficiency, water conservation, and increase water supply reliability. The Plum Basin project implements all of these project aspects by conserving surplus wet year waters and transforming them into a dependable groundwater supply that can be accessed by District growers and the municipal City of Tulare wells that provide the City's drinking water supply and fire flows. The increased conservation from this project is conservation of wet year surface water that would otherwise be beyond the District's ability to put it to beneficial use.

Climate Change Response Actions

This statewide priority category states that desirable proposals include that advance and expand conjunctive management of multiple water supply sources. The partnership between Tulare ID and the City of Tulare expands the conjunctive management of multiple water supply sources as the City is a municipal provider that only has access to groundwater and Tulare ID is an agricultural surface water provider that does not deliver groundwater. Together their partnership can expand their water resource management

of multiple supplies and increase water supply reliability through an increased diversity of supply.

18.2 Water Reuse Pipeline Project

The project is consistent with the following Program Preferences:

- Use of water more efficiently with significantly greater water conservation, recycling, and reuse to help meet future water demands and adapt to climate change (California Water Plan 2009);
- Expand conjunctive management of multiple supplies (California Water Plan 2009);
- Reduction of groundwater overdraft (California Water Plan 2009);
- Regional projects or programs; and
- CAL-FED Bay-Delta Program objective of water supply reliability.

Regional Project or Programs

This water reuse project involves a water management and cost sharing program between two regional Kaweah River Basin IRWM members. This partnership between an irrigation district and a municipality will help to address regional water management issues through leveraging resources that would not have been available if the partnership did not exist. The project will develop the existing wastewater supply into a useable irrigation supply, will garner the City an average of 6,500 acre-feet per year of additional groundwater recharge in recharge areas that will make groundwater supplies more reliable for the City, and it will diversify the water supplies available to Tulare ID so that water supplies are more reliable in the Kaweah River Basin Region. The project involves the construction of a new surface water delivery system and the development of a new exchange program between regional partners. Tulare ID will actively attempt to secure surplus water supplies from other regional partners for delivery to the City's preferred groundwater recharge sites through water transfers and sales on behalf of the City of Visalia.

CAL-FED Bay-Delta Program Objective: Water Supply Reliability

As discussed in Attachment 3, the project will diversify the water supplies available to both the City of Visalia and Tulare ID, will increase groundwater recharge by an average of 6,500 acre-feet per year in advantageous locations for the City of Visalia, and will generally make groundwater supplies more reliable in the Kaweah River Basin Region. The project and exchange program will allow the City to use their treated wastewater supply as a valuable commodity and exchange it for a surface water supply that can improve the City's groundwater reliability. The project and exchange program will allow

Tulare ID to leverage a small portion of their existing water rights to acquire a larger average annual volume of surface water from a more regulated and dependable source of supply. Prior to the implementation of this project and program, this exchange of resources would not have been possible. Increasing the amount of groundwater recharge and reusing water supplies is vital to the critically overdrafted Kaweah River Basin Region.

The project is also consistent with the following Statewide Priority:

- Drought Preparedness;
- Use and Reuse Water More Efficiently; and
- Climate Change Response Actions.

Drought Preparedness

The City of Visalia's Water Reuse Pipeline Project helps address drought preparedness within the City, Tulare ID and the Kaweah River region by promoting water reuse in the region, increasing water conservation potential, reducing long-term groundwater overdraft, increasing the reliability of groundwater resources that will be relied on by growers during drought times, and increasing the region's and the District's ability to efficiently manage the groundwater basin. This project will increase the amount of surface water intentionally recharged by the Tulare ID and the City and will thereby increase groundwater reliability.

Since neither Tulare ID nor the City of Visalia have sufficient surface water supplies to deliver water users all year long, every grower in the District must have a private groundwater well as does the City of Visalia for delivery of a domestic water supply. Surface water is seasonally available to local water users, and groundwater is the only reliable source of water to the either District or the City. Therefore both partners practice conjunctive use (conjunctively using surface and groundwater resources) and this project will expand the partners' conjunctive use efforts which will in turn better prepare them for drought conditions through increased groundwater recharge and diversity of water supplies. The increased groundwater supply would benefit irrigation districts and municipalities within the Kaweah River region not just during dry years, but also during years of reduced water allocations due to environmental concerns, as discussed in Attachment 7.

Use and Reuse Water More Efficiently

This statewide priority category includes projects that implement recycling and reuse, water use efficiency, water conservation, and increase water supply reliability. The

Water Reuse Pipeline project implements all of these project aspects by promoting water reuse in the region, increasing water conservation potential, reducing long-term groundwater overdraft, increasing the reliability of groundwater resources that will be relied on by growers during drought times, and increasing the region's and the partners' ability to efficiently manage the groundwater basin.

Climate Change Response Actions

This statewide priority category states that desirable proposals include that advance and expand conjunctive management of multiple water supply sources. The partnership between Tulare ID and the City of Visalia expands the conjunctive management of multiple water supply sources as the City is a municipal provider that only has access to groundwater and Tulare ID is an agricultural surface water provider that does not deliver groundwater. Together their partnership can expand their water resource management of multiple supplies and increase water supply reliability through an increased diversity of supply.

18.3 Paregien Basin Project

The project is consistent with the following Program Preferences:

- Use of water more efficiently with significantly greater water conservation, recycling, and reuse to help meet future water demands and adapt to climate change (California Water Plan 2009);
- Reduction of groundwater overdraft (California Water Plan 2009);
- Effectively recharge and use aquifers as water banks (California Water Plan 2009);
- Regional projects or programs;
- Protection and improvement of water supply reliability; and
- CAL-FED Bay-Delta Program objective of water supply reliability.

Water Conservation / Reduction of Groundwater Overdraft / Use of Aquifers as Water Banks

The project will recharge an average of 2,370 acre-feet per year that will make groundwater supplies more reliable in the Kaweah River Basin Region.

Regional Project or Programs

This basin project involves a water management and flood control program between two regional Kaweah River Basin IRWM members. This partnership between a water conservation district, a ditch company and a municipality will help to address regional

water management issues through leveraging resources that would not have been available if the partnership did not exist. The project will recharge an average of 2,370 acre-feet per year that will make groundwater supplies more reliable in the Kaweah River Basin Region.

CAL-FED Bay-Delta Program Objective: Water Supply Reliability

As discussed in Attachment 3, the project will recharge an average of 2,370 acre-feet per year that will make groundwater supplies more reliable in the Kaweah River Basin Region. As this is new project, this is recharge capacity has historically not available to the region. Increasing the amount of groundwater recharge and the available groundwater recharge capacity is vital to the critically overdrafted Kaweah River Basin Region.

The project is also consistent with the following Statewide Priority:

- Drought Preparedness;
- Use and Reuse Water More Efficiently; and
- Climate Change Response Actions.

Drought Preparedness

Kaweah Delta WCD's Paregien Basin Project helps address drought preparedness within the District and the Kaweah River region by increasing water conservation potential, reducing long-term groundwater overdraft, increasing the reliability of groundwater resources that will be relied on by growers during drought times, and increasing the region's and the District's ability to efficiently manage the groundwater basin. This project will increase the amount of surface water intentionally recharged by the District and will thereby increase groundwater reliability.

Since the majority of Kaweah Delta WCD growers do not have sufficient surface water supplies to irrigate with surface water all year long, most growers in the District must have a private groundwater well. Surface water is seasonally available to most growers in Kaweah Delta WCD and for them groundwater is the only reliable source of water to the District. This project will expand the Kaweah Delta WCD's conjunctive use efforts to be prepared for drought conditions through increased groundwater recharge. The increased groundwater supply would benefit irrigation districts and municipalities within the Kaweah River region not just during dry years, but also during years of reduced water allocations due to environmental concerns, as discussed in Attachment 7.

Use and Reuse Water More Efficiently

This statewide priority category includes projects that implement water use efficiency, water conservation, and increase water supply reliability. The Paregien Basin project implements all of these project aspects by conserving surplus wet year waters and transforming them into a dependable groundwater supply that can be accessed by District growers and the municipal City of Farmersville wells that provide the City's drinking water supply and fire flows. The increased conservation from this project is conservation of wet year surface water that would otherwise be beyond the District's ability to put it to beneficial use.

Climate Change Response Actions

This statewide priority category states that desirable proposals include that advance and expand conjunctive management of multiple water supply sources. The partnership between Kaweah Delta WCD and the City of Farmersville expands the conjunctive management of multiple water supply sources as the City is a municipal provider that only has access to groundwater and Kaweah Delta WCD is a water management agency that does not deliver groundwater. Together their partnership can expand their water resource management of multiple supplies and increase water supply reliability through an increased diversity of supply.

- Drought preparedness;
- Use and Reuse Water More Efficiently;
- Climate Change Response Actions;
- Practice Integrated Flood Management;
- Expand Environmental Stewardship;

18.4 Oakes Basin Habitat Enhancement Project

The project is consistent with the following Program Preferences:

- Expand Environmental Stewardship; and
- Protection, restoration, and improvement of stewardship of aquatic, riparian, and watershed resources within the region (California Water Plan 2009);

18.5 GW Quality Protection and Investigation

The project is consistent with the following Program Preferences:

- Include regional projects or programs (CWC §10544);
- Address critical water supply or water quality needs of disadvantaged communities within the region;
- Promote, improve and expand Integrated Regional Water management to create and build on Partnership that is essential for California water resources planning, sustainable watershed and floodplain management, and increasing regional self-sufficiency (California Water Plan 2009).

  - Protection of groundwater resources from contamination;
  - Protection and improvement of water supply reliability;
  - Protection and improvement of water quality within the area of the plan;
  - Identification and consideration of the water-related needs of disadvantaged communities in the area within the boundaries of the plan;
- Provision for sustainable groundwater use (California Water Plan 2009);
- Identify strategies to ensure communities that rely on contaminated groundwater will have a reliable drinking water supply (California Water Plan 2009);
- Ensure Equitable Distribution of Benefits;
- CAL-FED Bay-Delta Program objective of water supply reliability.

Regional Project or Programs

This groundwater quality project involves the investigation of groundwater quality issues throughout the Kaweah River Basin IRWM region and the destruction of conduits for groundwater contamination in several disadvantaged communities. This partnership between the County of Tulare and two local non-profit organizations will help to address regional water management issues through leveraging resources and specialties that would not have been available if the partnership did not exist. The project will develop up to three feasibility studies and preliminary engineering reports for conceptual projects addressing critical water needs in disadvantaged communities which if implemented will make groundwater supplies more reliable in the Kaweah River Basin Region.

CAL-FED Bay-Delta Program Objective: Water Supply Reliability

As discussed in Attachment 3, the project will destroy approximately 100 abandoned wells in disadvantaged communities and through the avoided potential risk of groundwater contamination will make groundwater supplies more reliable in the Kaweah River Basin Region.

ATTACHMENT 11 – PROGRAM PREFERENCES

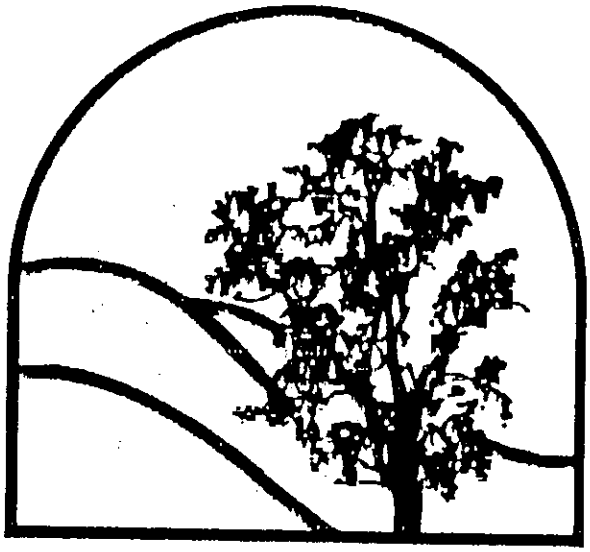
APPENDIX A

Kaweah Delta WCD Kaweah River Delta Corridor Study

KAWEAH RIVER DELTA
CORRIDOR ENHANCEMENT STUDY
PART ONE - WATER RESOURCES

FOR THE CITY OF VISALIA,
KAWEAH DELTA WATER CONSERVATION DISTRICT,
AND
TULARE COUNTY

DRAFT



By:

Camp Dresser & McKee, Inc.

May 1993 (Revised)

D.Keller

City of Visalia
Kaweah Delta Water Conservation District
Tulare County

Kaweah River Delta Corridor Enhancement Study

EXECUTIVE SUMMARY
Part One - Water Resources
Part Two - Environmental Habitat

July 1993

Prepared by:

CDM Camp Dresser & McKee

in association with

KASCO KAS Consultants

City of Visalia
Kaweah Delta Water Conservation District
Tulare County

Kaweah River Delta Corridor Enhancement Study

EXECUTIVE SUMMARY

July 1993

Executive Summary - Section 1
Introduction

1.1 Background

A multiple agency Task Force consisting of the City of Visalia, Kaweah Delta Water Conservation District (KDWCD), and Tulare County is planning to enhance wildlife habitat, water conservation and stormwater drainage in the Kaweah River Delta area. For this purpose, the Task Force has undertaken the Kaweah River Delta Corridor Enhancement Study. The study is a feasibility-level investigation to identify suitable sites along the river corridor to meet the multi-use objectives of groundwater recharge, stormwater protection, and environmental habitat restoration.

The Kaweah River Delta Corridor Enhancement Study Area (Study Area) lies on the east side of the central San Joaquin valley, just downstream of Terminus Dam. It is located between the St. Johns River on the north and the Kaweah River on the south, and extends on the west to the City of Visalia Urban Area Boundary. Most of the area is agricultural. A remnant of a significant Riparian Oak forest lies in the area and is unique in the southern San Joaquin Valley. The forest is an important wildlife habitat.

The study is to determine the potential to integrate two significant regional resources: riparian corridor habitat and water. The three goals are to provide expanded opportunities for plant and wildlife habitats, to conserve and reclaim drainage and stormwater, and to expand recharge areas and opportunities. This study identifies sites where detention or retention of stormwater flows will enhance wildlife habitat, help control flood drainage, and augment groundwater recharge.

1.2 Study Objective

The study is divided into two parts:

- *Part One* - Water Resources - focuses on surface and groundwater issues within the Kaweah River Delta. The Part One report describes the water resources investigation and findings.

- *Part Two* - Environmental Habitat Analysis - focuses on the significance of natural features, identifying natural habitat enhancement and preservation of a significant and threatened plant community. The Part Two report describes the environmental habitat analysis and findings.

The objective is to identify as many sites as possible which appear suitable as multi-use sites for groundwater recharge, stormwater protection, and environmental habitat enhancement.

1.3 Alternative Sites

The alternative sites found to be most suitable for water conservation and environmental habitat enhancement were identified and evaluated. A total of 23 alternative sites were initially identified, but access was denied to three sites. The remaining 20 sites are shown on Exhibit A (back pocket). Fourteen of the sites have potential water resources benefits, and were evaluated in Part One. All twenty sites were evaluated in Part Two.

A primary focus of the Part One Study was to identify potential water resources benefits for the City of Visalia, which helped to narrow the consideration of alternative sites. The Rocky Hill fault runs northwesterly through the study area, which tends to cause groundwater east of the fault to flow to the south rather than west toward Visalia. This constraint eliminated consideration of sites located east of approximately the Friant Kern Canal, due to reduced groundwater recharge benefits for Visalia. With respect to stormwater protection, the configuration of the channel system was a constraint which eliminated consideration of sites closer to the City (west of Cutler Park). The channels closer to the City are a network of small channels with limited potential for flood control benefits; there is no defined main channel where stormwater could be easily diverted and detailed. In addition, sites on the St. Johns River had limited potential for flood control benefits for the City. With respect to environmental habitat enhancement, lands closer to Visalia are intensively farmed and have less potential for environmental habitat benefits.

Based on these limiting constraints, 14 of the 20 sites were determined to have potential for water resources benefits and were selected for evaluation in Part One. These sites are labeled with numbers 1 through 14 on Exhibit A(back pocket). The 14 alternatives evaluated in Part One were further evaluated in Part Two. The Part Two study also evaluated six additional alternatives for potential environmental habitat benefits. These sites are labeled with numbers 15 through 20 on Exhibit A.

Executive Summary - Section 2
Water Resources Investigation
(Part One)

2.1 Part One Objective

Part One identified possible water detention or retention sites which could help to reduce peak storm flows, percolate water into the groundwater basin, and retain surface water to improve the wildlife habitat. Fourteen (14) alternative sites were identified as having potential water resources benefits.

2.2 Key Findings from Part One

Based on the water resources investigation, relative values were determined for groundwater recharge, flood control, and environmental habitat. The alternatives were ranked, taking into consideration flood control, environmental habitat, groundwater recharge, and annual storage cost per acre foot. The table below ranks the sites based on the water resources evaluation. Table 2-1 on the next page contains the details which led to this ranking.

Ranking No.	Alternative No.	Description
1	1	Consolidated Peoples Ditch
2	5	LSID (S.E.)
3	7	Kaweah Oaks (East)
4	4	LSID (S.W.)
5	10	Monrovia Reservoir
6	3	LSID (N.E.)
7	11	LSID (N.W.)
8	6	Kaweah Oaks (West)
9	14	SK Ranch
10	12	LSID (Farmed Land)
11	13	Yokohl Creek
12	9	Deep Creek Env. Habitat
13	8	Crocker Env. Habitat
14	2	St. Johns River

TABLE 2-1
PART ONE SUMMARY OF ALTERNATIVE RANKINGS

Overall Ranking	Alternative No. and Site Name	Surface Area (AC)	Pond Depth (FT.)	Storage Capacity (A.F.)	Values For			Storage Cost $/A.F. per year (4%, 15 YR)	Storage Cost $/A.F. per year (4%, 30 YR)	Storage Cost $/A.F. per year (6%, 15 YR)	Storage Cost $/A.F. per year (6%, 30 YR)
					Recharge Benefits	Flood Control	Environ. Habitat				
1	1. Consolidated People's Ditch	130	5	750	HIGH	HIGH	GOOD	69	46	79	57
2	5. LSID (S.E.)	80	3	240	HIGH	MEDIUM	GOOD	140	98	160	119
3	7. Kaweah Oaks (East)	170	3	510	HIGH	LOW	GOOD	134	92	153	113
4	4. LSID (S.W.)	250	3	750	HIGH	MEDIUM	GOOD	160	107	183	133
5	10. Monrovia Res.	190	5	950	LOW	HIGH	FAIR	137	99	156	119
6	3. LSID (N.E.)	140	2	280	HIGH	MEDIUM	GOOD	197	132	224	164
7	11. LSID (N.W.)	230	2	460	HIGH	LOW	GOOD	195	131	223	162
8	6. Kaweah Oaks (West)	150	2	300	HIGH	LOW	GOOD	204	140	231	171
9	14. SK Ranch	300	2	600	MEDIUM	HIGH	FAIR	234	154	267	191
10	12. LSID (Farmed Land)	120	2	240	HIGH	LOW	GOOD	246	166	280	204
11	13. Yokohl Creek	80	2	160	HIGH	LOW	GOOD	257	176	291	216
12	9. Deep Creek Envir. Hab.	15	2	30	LOW	LOW	GOOD	247	183	279	219
13	8. Crocker Envir. Hab.	5	2	10	LOW	LOW	GOOD	329	265	369	308
14	2. St. John's River	40	2	80	HIGH	LOW	POOR	475	475	475	475

Executive Summary - Section 3
Environmental Habitat Analysis
(Part Two)

3.1 Part Two Objective

Part Two identified potential sites where detention of stormwater flows could enhance and expand the riparian forests and hence the plant and wildlife species that it supports. Part Two also identified potential sites for long-term protection and/or acquisition, compile an inventory of plant and animal resources, and identified opportunities for passive recreation. The study focused on the remnants of the Great Valley valley oak riparian forest and valley oak woodland natural communities within the Kaweah River corridor and the many indigenous species that it supports. Twenty alternative sites were identified as having the potential to improve the environmental habitat. These sites included the 14 alternative sites evaluated in Part One.

3.2 Key Findings from Part Two

The twenty potential sites were independently evaluated for overall enhancement suitability without regard to factors such as size or suitability for groundwater recharge or flood control. After the sites had been categorized for enhancement suitability, they were ranked from best to worst. In the ranking analysis, factors such as size, contiguity with protected riparian habitat, and suitability for flood storage and recharge were used to differentiate among closely ranked sites. The table below ranks the sites based on the environmental habitat evaluation. Table 3-1 on the next page contains the details which led to this ranking.

Ranking No.	Alternative No.	Description
1	1	Consolidated Peoples Ditch
2	11	LSID (N.W.)
3	18	Cutler Park - North
4	3	LSID (N.E.)
5	2	St. John's River
6	5	LSID (S.E.)
7	13	Yokohl Creek
8	20	Jacob Ranch
9	4	LSID (S.W.)
10	19	Charter Oak
11	14	SK Ranch
12	6	Kaweah Oaks (East)
13	17	Kaweah River
14	9	Deep Creek Environmental Habitat
15	7	Kaweah Oaks (West)
16	8	Crocker Environmental Habitat
17	10	Monrovia Reservoir
18	16	Hannah Ranch
19	12	LSID (Farmed Land)
20	15	Lort Drive

TABLE 3-1

PART TWO COMPARISON OF SITE ALTERNATIVES

Site No.	Site Name	Soils	Hydrology	Historical Habitat Quality	Current Habitat Quality	Recreation Value	Protection Potential	Management Costs	Overall Enhancement Potential	Site Ranking
1	Consolidated Peoples Ditch	Good	Fair	Good	Fair	Good	High	Moderate	Good	1
2	St. Johns River	Good	Good	Fair	Good	Good	High	Low	Good	5
3	LSID-Northeast	Good	Good	Good	Good	Good	High	Low	Good	4
4	LSID-Southwest	Good	Good	Fair	Good	Good	High	Low	Fair	9
5	LSID-Southeast	Good	Good	Good	Fair	Good	High	Low	Good	6
6	Kaweah Oaks-West	Good	Good	Good	Good	Good	Low	High	Fair	15
7	Kaweah Oaks-East	Good	Good	Good	Excellent	Good	Low	Low	Fair	12
8	Crocker Envir. Habitat	Good	Good	Good	Excellent	Poor	High	Low	Fair	16
9	Deep Creek Envir. Habitat	Good	Good	Good	Fair	Poor	High	Moderate	Fair	14
10	Monrovia Reservoir	Good	Good	Fair	Poor	Good	High	High	Poor	17
11	LSID-Northwest	Good	Good	Good	Good	High	Low	Low	Good	2
12	LSID-Farmed	Good	Good	Fair	Poor	Good	High	High	Poor	19
13	Yokohl Creek	Good	Good	Good	Fair	Poor	High	Moderate	Good	7
14	S. K. Ranch	Good	Good	Good	Poor	Good	High	High	Fair	11
15	Lort Drive	Good	Fair	Fair	Fair	Good	High	Moderate	Poor	20
16	Hannah Ranch	Good	Fair	Fair	Poor	Good	High	High	Poor	18
17	Kaweah River	Good	Good	Good	Fair	Poor	High	Moderate	Fair	13
18	Cutler Park-North	Good	Fair	Good	Fair	Poor	High	Moderate	Good	3
19	Charter Oak	Good	Good	Good	Good	Good	High	Low	Good	10
20	Jacob (McCain) Ranch	Good	Good	Good	Excellent	Poor	High	Low	Fair	8

Executive Summary - Section 4
Summary and Recommendations

4.1 Discussion of Key Findings from Parts One and Two

The results show that riparian habitat can be restored almost anywhere within the Kaweah River corridor, including agricultural lands. But the costs of acquisition and intensive management required to restore agricultural land make it impractical to improve them in light of much more feasible alternatives on existing natural lands. It is more difficult to find sites with the appropriate topography, hydrogeology, and surface water hydrology that will enable the construction of flood storage and groundwater recharge facilities than it is to find sites where riparian habitat can be enhanced or restored. Therefore, greater weight is given to sites which can provide good flood control and recharge benefits.

Table 4-1, shown on the next page, compares the rankings for both the water resources and the environmental habitat analysis. Several of the alternative sites appear to have good potential to meet all three of the project objectives. Of the sites ranked in the top eight for recharge and flood control, five were also in the top eight for riparian enhancement.

The Consolidated Peoples Ditch site is the top-ranked site in both Part One and Part Two. It has the potential to enhance the environmental habitat and is contiguous with existing protected habitat on the Kaweah Oaks Preserve. Four of the six sites owned by the Lindsay-Strathmore Irrigation District (LSID) ranked high in both studies and are well suited to meet all three project objectives. The LSID (SW) site is not as highly ranked for habitat enhancement because there is evidence that it may never have supported significant riparian forest habitat.

Three sites that were highly ranked in Part One did not score well in Part Two: Monrovia Nursery, Kaweah Oaks (East), and Kaweah Oaks (West). The Monrovia Nursery site was not highly ranked in Part Two, primarily because it probably never supported significant riparian forest habitat and because management costs to restore riparian habitat would be very high. The Kaweah Oaks sites were not highly ranked because they already support excellent riparian forest habitat and are protected by an organization with strict conservation policies.

Two other sites which were highly ranked for riparian enhancement suitability and had high potential benefits for groundwater recharge were Cutler Park - North and the St. Johns River. But the St. Johns River site was not highly ranked in Part One because of high operation costs per acre foot of groundwater recharge and the Cutler Park - North site was eliminated because of potential interference with septic leach fields in the neighboring Oak Ranch subdivision.

TABLE 4-1

COMPARISON OF PART ONE AND PART TWO RANKINGS

Alternative No.	Description	Part One Ranking	Part Two Ranking
1	Consolidated Peoples Ditch	1	1
5	LSID (S.E.)	2	6
7	Kaweah Oaks (East)	3	12
4	LSID (S.W.)	4	9
10	Monrovia Reservoir	5	17
3	LSID (N.E.)	6	4
11	LSID (N.W.)	7	2
6	Kaweah Oaks (West)	8	15
14	SK Ranch	9	11
12	LSID (Farmed)	10	19
13	Yokohl Creek	11	7
9	Deep Creek Env. Habitat	12	14
8	Crocker Env. Habitat	13	16
2	St. Johns River	14	5
18	Cutler Park - North	NA[1]	3
20	Jacob Ranch	NA[1]	8
19	Charter Oak	NA[1]	10
17	Kaweah River	NA[1]	13
16	Hannah Ranch	NA[1]	18
15	Lort Drive	NA[1]	20

[1] Alternatives 15 through 20 were not ranked in Part One. They were screened out in the initial identification of sites as having little potential for water resources benefits.

4.2 Recommendations

The results of the Part One and Part Two feasibility-level study indicate that the potential does exist for sites along the Kaweah River Delta Corridor to provide multiple benefits for groundwater recharge, flood control and environmental habitat enhancement. There are enough potential feasible sites identified to warrant proceeding with the project. The feasible sites identified in this study should be further evaluated in detail in future phases of the project.

City of Visalia
Kaweah Delta Water Conservation District
Tulare County

Kaweah River Delta Corridor Enhancement Study

PART ONE - WATER RESOURCES

May 1993
Revised July 1993

Part One - Section 1
Introduction

1.1 Study Background

A multiple agency task force consisting of the City of Visalia, Kaweah Delta Water Conservation District (KDWCD) and Tulare County is planning to enhance wildlife habitat, water conservation and storm water drainage in the Kaweah River Delta area. For this purpose, the Task Force has undertaken the Kaweah River Delta Corridor Enhancement Study. The study is a feasibility-level investigation to identify suitable sites along the river corridor to meet the multi-use objectives of groundwater recharge, stormwater protection, and environmental habitat restoration.

The Kaweah River Delta Corridor Enhancement Study Area (Study Area) lies in the central San Joaquin valley on the east side, just downstream of Terminus Dam. It is located between the St. Johns River on the north and the Kaweah River on the south, and extends west to Cutler Park (approximately 23,000 acres). A remnant of a significant Riparian Oak forest in this area is unique in the southern San Joaquin valley and is an important wildlife habitat.

The study is to determine the potential to integrate two significant resources in the region; riparian corridor habitat and water. The project goals are to provide for expanded opportunities for plant and wildlife habitats, to conserve and reclaim drainage and storm water, and to expand recharge areas and opportunities. The ultimate plan will identify sites where detention/retention flows will enhance wildlife habitat, help control flood drainage and expand ground water recharge.

1.2 Study Objective

The study is divided into the following two parts:

- *Part One* - Water Resources - focuses on surface and ground water issues within the Kaweah River Delta.

- *Part Two* - Environmental Habitat Analysis - focuses on significance of natural features identifying natural habitat enhancement and preservation of a significant and threatened plant community.

Camp Dresser & McKee (CDM) was authorized to complete the *Part One* - Water Resources portion of the Study. CDM in association with KAS Consultants (KASCO) were then authorized to complete the *Part Two* - Environmental Habitat Analysis portion of the study.

The objective was to identify as many sites as possible which appear suitable for multiple use for groundwater recharge, stormwater protection, and environmental habitat enhancement. The alternative sites found to be most suitable for water conservation and environmental habitat enhancement were identified and evaluated. A total of 23 alternative sites were initially identified; however, access was denied on three sites. The remaining 20 sites are shown on Exhibit A

(back pocket). Fourteen of the sites had identified potential water resources benefits, and were evaluated in Part One. All twenty sites were evaluated in Part Two.

1.3 Part One Introduction

This *Part One* study focused on identifying possible water detention/retention sites which could help to reduce peak storm flows, percolate water into the ground water basin and retain surface water for wildlife habitat. Rough estimates indicate that the City of Visalia is in need of approximately 600 cfs additional diversion capacity for flood control purposes and approximately 800 to 1200 acre feet of additional retention storage to control peak storm run-off.

A primary focus of the Part One Study was to identify potential water resources benefits for the City of Visalia, which helped to narrow consideration of alternative sites. The Rocky Hill fault runs northwesterly through the study area, which tends to cause groundwater east of the fault to flow to the south rather than west toward Visalia. This constraint eliminated consideration of sites located east of approximately the Friant Kern Canal, due to reduced groundwater recharge benefits for Visalia. With respect to stormwater protection, the configuration of the channel system was a constraint which eliminated consideration of sites closer to the City (west of Cutler Park). The channels closer to the City are a network of small channels with limited potential for flood control benefits; there is no defined main channel where stormwater could be easily diverted and detained. In addition, sites on the St. Johns River had limited potential for flood control benefits for the City. With respect to environmental habitat enhancement, lands closer to Visalia are intensively farmed and have less potential for environmental habitat benefits.

Based on these limiting constraints, 14 sites with potential for water resources benefits were identified for evaluation in Part One. These sites are labeled with numbers 1 through 14 on Exhibit A (back pocket). The 14 alternatives selected for study in Part One were evaluated by estimating values for ground water recharge, flood control, environmental enhancement, capital and operating costs and resulting storage capacity cost on a dollars per acre-foot per year evaluation. This evaluation resulted in a preliminarily ranking of alternative sites 1 through 14.

The alternatives evaluated in the *Part One* study were further evaluated in the *Part Two Environmental Habitat Analysis*. The Part Two study also evaluated six additional alternatives for potential environmental habitat benefits. These sites are labeled with numbers 15 through 20 on Exhibit A. The Part Two study is described separately.

Part One - Section 2
General Descriptions

2.1 General Hydrogeologic Description

The Study Area occupies the upper portion of the Kaweah River alluvial fan. A number of streams run across this fan, and many are distributaries of the Kaweah River. The St. Johns River divides from the Kaweah River at McKays Point, near the head of the fan. There also are a number of lesser distributaries, such as Deep Creek, Outside Creek, and Johnson Slough. Kaweah River ceases to be an identifiable stream near the west boundary of the study area, where the river branches into Mill Creek and other streams. A few tributaries, such as Dry Creek and Yokohl Creek, enter the fan area and are tributary to the Kaweah and St. Johns Rivers.

There are a number of diversion works located on the Kaweah alluvial fan. These works divert water from the Kaweah River, from the St. Johns River, and from other streams into canals and ditches operated by a number of water entities.

2.2 General Geology Description

The Kaweah River alluvial fan is characterized by a surface of low, rolling topographic relief that is composed of Holocene[1] alluvial fan deposits. Soils are generally sandy and gravelly, permeable, and fertile. Zones of impermeable hardpan are present in the subsurface at certain localities.

The Kaweah River has an indistinct channel that generally is less than five feet deep. Downstream from McKays Point, the channels of both the Kaweah and St. Johns Rivers are largely confined by artificial levees. Interfan areas composed of older alluvium occur on each side of the fan. Here, deposits are comprised of sandy clays containing subsurface layers of hardpan. Infiltration and permeability rates in the older alluvium are lower than those of the deposits of the Kaweah River fan.

The Venice Hills, located about two miles east and southeast of the community of Ivanhoe, pierce the Kaweah River fan. These hills are composed of non-water-bearing ultrabasic rocks (serpentine, peridotite, etc.) that form a part of a foothill ultrabasic belt that extends southeasterly toward Exeter and Success Reservoir. The St. Johns River flows through a natural notch in these hills.

Six zones of diatomaceous clay ("A"-clay through "F"-clay) have been identified in the subsurface in the San Joaquin Valley. The best known of these is the "E"-clay, or Corcoran Clay. The "E"-clay has a profound effect on groundwater in much of the San Joaquin Valley. Croft and Gordon indicate that none of these diatomaceous clay zones are present in the subsurface east of the City of Visalia. Hence, none is of importance to groundwater in the study area.

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[1] Holocene deposits were formed during the past 10,000 years.

The Rocky Hill Fault has been identified by Bookman and Edmonston as striking northwesterly across the Kaweah River fan. The trace of this fault runs from Exeter northwesterly to the west of Ivanhoe. The west side of the fault has been identified as being the downdropped side. Such a fault would explain the presence of exposed bedrock in the Venice Hills. Within the study area, groundwater east of the fault tends to flow south; groundwater west of the fault tends to flow west.

2.3 Soils

2.3.1 General Soils Description

Stephens has identified and evaluated the soils of the central portion of Tulare County to a depth of about 60 inches. The soil survey was performed for that portion of the county immediately east and north of much of the study area. The survey shows the areal extent of the various soil types, soil classifications and characteristics, engineering properties of soils, and other soil criteria. Preliminary soils data were made available for the remainder of the Study Area by the Hanford office of the U.S. Department of Agriculture, Soil Conservation Service.

2.3.2 Soil Classification

Soils can be classified for engineering purposes using the Unified Soil Classification System. This system divides soils into plastic (clayey) soils and non-plastic (granular) soils. Granular soils are further divided by their grain size gradation. A brief description of the sand, silt, and clay portions of the Unified Soil Classification System is given below:

Symbol	Description
SW	Well-graded sands or gravelly sands; little or no fines.
SP	Poorly-graded sands or gravelly sands; little or no fines.
SM	Silty sands and sand-silt mixtures.
SC	Clayey sands and sand-clay mixtures.
ML	Silts and very fine sands, clayey silts; very low plasticity.
MH	Elastic silts, diatomaceous fine sandy silts; high plasticity.
CL	Lean clays, sandy clays, silty clays; low plasticity.
CH	Fat clays; high plasticity

2.3.3 Soil Permeability

Use of the Unified Soil Classification System enables an estimate to be made of the permeability of a particular soil. Permeabilities can be expressed in a number of ways. The most common expression for groundwater purposes is in units of cubic feet per day per square foot of cross-sectional area (ft/day). Permeability ranges for soil types in the study area are shown below:

SOIL PERMEABILITIES

Unified Soil Classification System Symbol	Range of permeability[1]
SW	>3.0
SP	>3.0
SM	0.003-3.0
SC	0.00003-0.003
ML	0.003-3.0
MH	0.003-0.3
CL and CH	0.00003-0.003

[1] In units of cubic feet per day per square foot of cross-sectional area (ft/day).

2.4 Groundwater

2.4.1 Groundwater Basin Description

The California Department of Water Resources (DWR) has identified the Kaweah River fan area as being a distinct groundwater basin, named by DWR the Kaweah Basin. The basin generally comprises lands in the KDWCD.

2.4.2 Groundwater Replenishment and Movement

High quality usable groundwater is found throughout the Study Area. Water bearing aquifers occur in unconfined, semi-confined and confined areas. However, the Kaweah River Alluvial deposits in the Study Area generally contain unconfined conditions (Appendix C, Reference 1). West of the Study Area in the California Water Service Company service area (City of Visalia), the standing water level (SWL) is declining. In 1986 the standing water level (average) was approximately 50 feet (below ground); today it is approximately 92 feet. The Study Area may not be impacted as greatly as Visalia in that the Study Area is closer to the Sierra Mountains recharge areas and the hydraulic gradient is from East to West. However, groundwater recharge in the Study Area will favorably impact the groundwater conditions in the Visalia area which is an objective of this study.

For additional information the reference material in Appendix C contains a thorough analysis of the hydrogeologic conditions in the study area. In addition the KDWCD monitors wells (standing water levels) in their service area twice annually and reports this information to the

State of California Department of Water Resources (Fresno, California). According to Croft and Gordon (Appendix C, Reference 5), seepage of water from rivers, streams, canals, ditches, and irrigation water applied in excess of plant and soil moisture requirements, constitute the principal sources of water infiltrating to the groundwater body. Annual cyclical fluctuation of the water table reflect climatic conditions, the magnitude of winter/spring replenishment, and the quantity of summer/fall pumpage. Bookman and Edmonston (Appendix C, Reference 1) estimated that the average annual groundwater replenishment from the Kaweah River system amounted to 200,000 acre-feet.

Unconfined groundwater moves in a direction that is generally parallel to the surface water flow. Croft and Gordon reported that the gradient of unconfined groundwater along the Kaweah River in 1962 ranged from 10 to 25 feet per mile. Bookman and Edmonston report similar groundwater gradients in 1966. According to data from Croft and Gordon, the Kaweah River, St. Johns River, and their associated lesser streams and ditches, constitute a losing stream system, that is, the combined system provides natural recharge to the groundwater body.

In general, the channels which pass through the study area do not contain water throughout any given year. Even in the best of years, runs on high-entitlement channels do not normally exceed a nine to ten month duration. In some years, the channels would not have been saturated for any more than a two month period. Conditions do not exist, therefore, which allow for equilibrium to be established between the surface water elevations in a channel and the groundwater conditions over the area comprising any subject parcel. While there may be some equilibrium in the immediate bank storage areas paralleling a given channel, groundwater conditions on the parcel as a whole are substantially lower than the water surface elevation in any given channel. Even with regard to bank storage conditions, a gradient is quickly established upon leaving the wetted perimeter of the channel due to surrounding groundwater conditions. Therefore, the groundwater levels at the alternative sites could generally be expected to be similar to the overall groundwater table in the area.

Declines in standing water levels in the Visalia Area have ranged from 5 to 6 feet per year over the past seven years. According to a 1968 report published by the USGS (Appendix C, Reference 5), a portion of the declines experienced after 1961 was thought to reflect a reduction in recharge because of impoundment of Kaweah River flows behind Terminus Dam. However, there was no recent information available on the potential impact of impoundment of Kaweah River flows behind Terminus Dam.

A general assessment of groundwater conditions within the study area was made for this Part One reconnaissance-level feasibility study. The Part One work did not include review of detailed existing information on groundwater levels and conditions. The Kaweah Delta Water Conservation District takes spring and fall readings at wells throughout the study area. In addition, there are wells on the alternative sites. Future phases of the project should include a detailed hydrogeologic analysis of selected sites using the existing data an groundwater levels and conditions.

2.4.3 Groundwater Quality

Groundwater recharged from the Kaweah River system tends to be of calcium bicarbonate type suitable for most beneficial uses. Dissolved solids range from 120 to 270 milligrams per liter.

2.4.4 Groundwater Storage Capacity

Davis and others estimated groundwater storage capacity by townships for various areas in the San Joaquin Valley for the depth zone from 10 to 200 feet. The Kaweah River fan occupies a portion of T18S, R25E and T18S, R26E, MDB&M. Davis and others estimated that these two townships have a combined groundwater storage capacity of 813,000 acre feet. There are no data readily available on groundwater storage capacity below a depth of 200 feet, nor for the quantity of groundwater currently in storage.

2.4.5 Groundwater Overdraft

Groundwater overdraft in the Kaweah Basin was estimated at 150,000 acre-feet in 1975 (Appendix C, Reference 9). Water level declines throughout much of the basin are attributed to the development of irrigated agriculture on lands to the west of Road 68 and having an inadequate surface water supply. The conversion of agricultural lands to urban development and the removal of surface irrigation water from additional lands contributes to groundwater overdraft. Maximum groundwater level declines have exceeded six feet per year in the western part of the Kaweah basin.

2.4.6 Land Subsidence

According to DWR reports, groundwater withdrawals in the western part of the Kaweah basin have caused a total of about five feet of land subsidence during the period 1957 through 1970.

2.5 Environmental Habitat Description

Soils can be classified according to their potential for environmental habitat. This classification includes consideration for native vegetation such as grasses, legumes, herbaceous plants, hardwoods, shrubs, and wetland plants. The classification also includes consideration for animal life, such as open-land wildlife and wetland wildlife. Four classes of environmental habitat potential are used in this Part One study. They are defined as follows:

GOOD - A habitat that can be easily established, improved, or maintained. It has few or no limitations that would affect wildlife management. Satisfactory management results can be expected.

FAIR - A habitat that can be established, improved or maintained in most places. Moderately intensive management is required for satisfactory results.

POOR - A habitat can be established, improved or maintained in a few places, but management is difficult and must be intensive.

VERY POOR - Restrictions are very severe for establishing, improving, and maintaining a habitat. Because unsatisfactory results usually can be expected, a habitat would be impractical or impossible to establish, improve, or maintain. None of the sites investigated were classified as Very Poor.

A preliminary assessment of environmental habitat potential was conducted during Part One. An environmental habitat analysis of the sites was conducted during Part Two.

2.6 Investigation Methodology Description

The hydrogeologic element of this investigation consisted solely of an office appraisal and evaluation of the various sites through the use of readily available data and published reports. Field reconnaissance was performed to estimate sites suitability and rough cost estimates for improvements.

Two open-file reports from the U.S. Geological Survey provide information on geology, hydrogeology, and groundwater, viz, Davis and others, 1957, and Croft and Gordon, 1968. The areal geology information is corroborated by the map by Mathews and Burnett, 1965. Information on groundwater overdraft is derived from data published by DWR. Soils and environmental habitat data for the eastern portion of the Study Area were taken from Stephens, 1982. Soils and environmental habitat data for the remainder of the Study Area were derived from field data provided by the U.S. Soil Conservation Service. Ground data also were determined from a series of aerial photographs taken during 1987 flights. Groundwater level, groundwater quality, and water well data are available for the Study Area through the KDWCD.

Complete bibliographic citations are shown in Appendix C.

Part One - Section 3
Discussion of Alternatives

3.1 Identification of Alternative Sites

Twenty alternatives were identified for consideration as possible multi-use sites for groundwater recharge, flood control, and environmental habitat enhancement. These sites are shown on Exhibit A (back pocket).

A primary focus of Part One was to identify potential water resources benefits for the City of Visalia, which narrowed the consideration of alternative sites. The Rocky Hill fault runs northwesterly from Exeter to Ivanhoe and cuts the study area. Groundwater east of the fault tends to flow to a south rather than west toward Visalia. This constraint eliminated consideration of located sites east of approximately the Friant Kern Canal, due to reduced groundwater recharge benefits for Visalia. With respect to stormwater protection, the configuration of the channel system was a constraint which eliminated consideration of sites closer to the City (west of Cutler Park). The channels closer to the City are a network of small channels with limited potential for flood control benefits; there is no defined main channel where stormwater could be easily diverted and detained. In addition, sites on the St. Johns River have limited potential for flood control benefits for the City. With respect to environmental habitat enhancement, lands closer to Visalia are intensively farmed and have less potential for environmental habitat benefits.

Based on these limiting constraints, 14 sites with potential for water resources benefits were identified for evaluation in Part One. These sites are labeled with numbers 1 through 14 on Exhibit A (back pocket) and are listed in Section 3.2. Other sites investigated, but not selected for consideration in Part One, are identified in Appendix A.

The 14 alternatives evaluated in Part One were also evaluated in the Part Two Environmental Habitat Analysis, as well as six alternatives which did not have identified water resources benefits. These sites are numbered 15 through 20 on Exhibit A (back pocket), and labelled as Lort Drive (15), Hannah River (16), Kawewah River (17), Cutler Park North (18), Charter Oak (19), and Jacob Ranch (20). The Part Two analysis is described separately.

3.2 Alternative Sites Evaluated in Part One

The following 14 sites for off-stream and in-stream facilities were evaluated in Part One:

1. Consolidated People's Ditch Site
2. St. Johns River
3. LSID - Northeast Site
4. LSID - Southwest Site
5. LSID - Southeast Site
6. Kaweah Oaks (West) Site
7. Kaweah Oaks (East) Site
8. Crocker Environmental Habitat Site
9. Deep Creek Environmental Habitat Site

10. Monrovia Reservoir Site
11. LSID - Northwest Site
12. LSID - Farmed Land Site
13. Yokohl Creek Site
14. S. K. Ranch Site

This section contains a brief discussion of these alternatives with respect to hydrogeologic, groundwater, flood control, and environmental habitat factors.

3.2.1 Alternative 1 - Consolidated People's Ditch Site (Paregien Ranch)

The Consolidated People's Ditch site occupies an area between Deep Creek and Johnson Slough, just south of Highway 198. It occupies about 130 acres in Section 32, T18S, R26E, MDB&M. Ground elevation ranges from about 370 feet at the southern boundary to 375 feet at Highway 198. Consolidate People's Ditch borders the site on the east and Deep Creek on the west. The site is not developed and appears to be 5 to 10 feet lower than the surrounding area. Ponding on this site would require little berming for a 5 foot depth. Storm flows and percolation water could be diverted into this area from Consolidated People's Ditch.

Geology and Soil

The site is underlain by Holocene alluvial fan deposits. Most of these deposits are composed of Grangeville sandy loam (drained phase). The upper 16 inches of the Grangeville soil column is composed of a brown sandy loam (Unified Soil Classification System symbol SM); from that depth to a depth of 67 inches is a light brown loam to grayish brown sandy loam (Unified Soil Classification System symbol SM). This Grangeville soil has a permeability in the range of 5 to 15 ft/day from the ground surface to a depth of 64 inches.

Two small areas, one at Highway 198 and the other south of the highway and west of Johnson Slough, are composed of Kaweah fine sandy loam. The material extends to a depth of 60 inches; the soil column is composed of light brown fine sandy loam (Unified Soil Classification System symbol SM-ML) to a depth of 16 inches and a pale brown fine sandy loam (Unified Soil Classification System symbol SM-ML-CL) below that. The permeability of this Kaweah soil is in the range of 5 to 15 ft/day.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. Groundwater is expected to be unconfined. It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The site has a high recharge potential and should be capable of being developed into a viable groundwater recharge facility. This rationale is based on the presence of moderately permeable soils (Grangeville sandy loam and Kaweah fine sandy loam), its location near the axis of the

Kaweah River fan, the probable presence of coarse-grained subsurface materials, and the apparent lack of barriers to groundwater movement.

Flood Control Potential

This site has a high potential as a flood control facility because of its off-stream location and hydrogeologic setting.

Environmental Habitat Potential

Preliminary data provided by the U.S. Soil Conservation Service for Grangeville sandy loam indicate that it has environmental habitat characteristics similar to Grangeville silt loam, found farther to the east. Characteristics for the silt loam are shown below:

Soil Type	Habitat	Good	Fair	Poor	Very Poor
Grangeville	Grass	X	-	-	-
	Legumes	X	-	-	-
	Herbaceous plants	X	-	-	-
	Hardwoods	X	-	-	-
	Shrubs	X	-	-	-
	Wetland plants	-	X	-	-
	Open-land wildlife	X	-	-	-
	Wetland wildlife	-	-	X	-

The U.S. Soil Conservation Service has not formally mapped the wildlife habitat potential for the Kaweah soils. However, based on verbal discussions with their staff, the Kaweah soils would be expected to be in the habitat range from Fair to Good.

3.2.2 Alternative 2 - St. Johns River Site

The St. Johns River site occupies the bed of the stream from the railroad bridge near Road 180 downstream to the western boundary of Cutler Park. The site occupies about 40 acres in Sections 13, 23, and 24, T18S, R26E, MDB&M. Ground elevation ranges from about 355 feet at Cutler Park to about 385 feet at the railroad bridge. This site involves berming the river bed up 2 to 3 feet in check dikes for spreading basins in the river bed from Cutler Park east to the Tulare Irrigation Ditch crossing (approximately 2-1/2 miles). The bed of the river would have to be reworked on an annual basis for effective groundwater recharge. This alternative appears very suitable but costly compared to other alternatives due to the annual maintenance. Structures would require design approval from KDWCD, must be removable, and must not be in place when there is no excess water available for percolation (e.g., Grant check gate).

Geology and Soils

The St. Johns River meanders across the surface of the Kaweah River fan. A portion is incised and a portion is contained by levees. Its bed is composed of loose, unconsolidated, highly permeable deposits of silt, fine to coarse sand, and stringers of fine gravel, all of which are identified by the U.S. Soil Conservation Service as riverwash.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. It is expected that groundwater in stream bed areas will be unconfined. This site is an in-stream facility. The river generally is a losing stream along this reach. The groundwater conditions of the immediate bank storage area would vary depending on surface water conditions. However, a gradient would quickly be established with the overall groundwater table in the area.

Recharge Potential

The recharge potential of the St. Johns River bed is expected to be high. According to Croft and Gordon, the river is a losing stream at least as far west as its crossing with Highway 63, some three miles west of Cutler Park.

Flood Control Potential

This site has a no potential as a flood control facility because of its in-stream location.

Environmental Habitat Potential

The environmental habitat potential for areas of riverwash has not been formally rated by the U.S. Soil Conservation Service. Because of flooding, the river bed is not a site for vegetation other than some annual grasses during low water stages. Aquatic birds and animals may use this reach of the river as a habitat. Hence, the site is considered to have a poor environmental habitat potential.

3.2.3 Alternative 3 - LSID (Northeast) Site

The Lindsay-Strathmore Irrigation District (LSID)-Northeast site occupies 140 acres in Section 14, T18S, R26E, MDB&M. It is located to the north of the Kaweah River and immediately east of Road 188. Ground elevation ranges from about 395 feet at the southwestern corner to about 405 feet at its northeastern corner, near Lane Slough. Lane Slough water could be diverted into this area. The land elevation is near the same as elevation of Road 196, and the site does not appear it would make a good flood basin area due to lack of ponding depth and potential of flooding Road 196 with a dike failure. The site would be difficult to flood due to the high ground elevation.

Geology and Soils

The LSID-Northeast site is situated on Holocene alluvial fan deposits. Soils are composed of Grangeville sandy loam (drained phase) and Kaweah fine sandy loam, similar to those at the Consolidated People's Ditch site (see description for Alternative 1). The Kaweah soils are

exposed in an east-west band across the middle of the site. To the north and to the south, Grangeville soils are exposed.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. There are indications that groundwater has been developed at the site for agricultural purposes. It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The recharge potential of the LSID-Northeast site is expected to be high, and similar to that of the Consolidated People's Ditch site (see description for Alternative 1).

Flood Control Potential

This site has a medium potential as a flood control facility because of its location and hydrogeologic setting.

Environmental Habitat Potential

The environmental habitat potential of the LSID-Northeast site is expected to be good, and similar to that of the Consolidated People's Ditch site (see description for Alternative 1).

3.2.4 Alternative 4 - LSID (Southwest) Site

The LSID-Southwest site occupies 250 acres in Sections 14, 15, 22, and 23, T18S, R26E, MDB&M. Its north boundary is the Lower Kaweah River, and its south boundary is formed by Avenue 304 and the Consolidated People's Ditch. It extends from the Santa Fe tracks, near Yokohl Creek, nearly to Lort Drive, on the Southern Pacific. Ground elevation ranges from about 390 feet at the western boundary to about 400 feet at its eastern boundary. This site appears to drain from south to north toward the Kaweah River and would require berming of 2 to 3 feet high around the property for containment.

Geology and Soils

The LSID-Southwest site is situated on Holocene alluvial fan deposits. Soils are composed of Grangeville sandy loam (drained phase) and Kaweah fine sandy loam, similar to those at the Consolidated People's Ditch site (see description for Alternative 1). The Kaweah soils are exposed at three separate areas; Grangeville soils are exposed in the remainder of the site.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. There are indications that groundwater has been developed at the site for agricultural purposes. Groundwater conditions are expected to be similar to those at the

Consolidated People's Ditch site (see description for Alternative 1). It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The recharge potential of the LSID-Southwest site is expected to be high, and similar to that of the Consolidated People's Ditch site (see description for Alternative 1).

Flood Control Potential

This site has a medium potential as a flood control facility because of its location and hydrogeologic setting.

Environmental Habitat Potential

The environmental habitat potential of the LSID-Southwest site is expected to be good, and similar to that of the Consolidated People's Ditch site (see description for Alternative 1).

3.2.5 Alternative 5 - LSID (Southeast) Site

The LSID-Southeast site occupies 80 acres in Section 14, T18S, R26E, MDB&M. Its north boundary is the Lower Kaweah River, and its south boundary is formed by Avenue 304 and the Consolidated People's Ditch. It extends from the Santa Fe tracks, near Yokohl Creek, eastward approximately 2,500 feet. Ground elevation ranges from about 400 feet at the western boundary to about 405 feet at its eastern boundary. This site is between the Consolidated People's Ditch and the railroad tracks. A retention basin could be made by the Consolidated People's Ditch at the Highway (intersection of Lort Drive and Highway 196) and the railroad tracks. The property could be bordered up 3 to 4 feet in order to make a flood basin. The area is now used for cattle grazing.

Geology and Soils

The LSID-Southeast site is situated on Holocene alluvial fan deposits. Soils are composed of Grangeville sandy loam (drained phase) and Kaweah fine sandy loam, similar to those at the Consolidated People's Ditch site (see description for Alternative 1). The Kaweah soils are exposed at three separate areas; Grangeville soils are exposed in the remainder of the site.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. There are indications that groundwater has been developed at the site for agricultural purposes. Groundwater conditions are expected to be similar to those at the Consolidated People's Ditch site (see description for Alternative 1). It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The recharge potential of the LSID-Southeast site is expected to be high, and similar to that of the Consolidated People's Ditch site (see description for Alternative 1).

Flood Control Potential

This site has a medium potential as a flood control facility because of its location and hydrogeologic setting.

Environmental Habitat Potential

The environmental habitat potential of the Grangeville soils at the LSID-Southeast site is expected to be good, and similar to that of the Consolidated People's Ditch site (see description for Alternative 1).The U.S. Soil Conservation Service has not formally mapped the wildlife habitat potential for the Kaweah Soils. However, based on verbal discussions with their staff, the Kaweah Soils would be expected to be in the habitat range from Fair to Good.

3.2.6 Alternative 6 - Kaweah Oaks (West) Site

The Kaweah Oaks (West) site is located between Deep Creek and the Tulare Irrigation District canal; directly north of Highway 198. It occupies about 150 acres in Section 29, T18S, R26E, MDB&M. Ground elevation ranges from about 375 feet at the southwest corner at Highway 198 to about 380 feet at the northeast corner. This property is owned by The Nature Conservancy (TNC), which is an international non-profit conservation organization. TNC may work with the City in cooperating and providing land. TNC is interested in preserving the land for long term open space usage. They are currently in the process of turning this land over to a local non-profit corporation, Four Creeks Land Trust. Four Creek's objective is for local control to provide a broad opportunity management base for the land trust's improvements of wildlife habitat.

Geology and Soils

The site is situated on Holocene alluvial fan deposits. Soils are composed of Grangeville sandy loam (drained phase) similar to those at the Consolidated People's Ditch site (see description for Alternative 1), and also Nord fine sandy loam. The Grangeville soils are exposed near Deep Creek, while the Nord soils are exposed farther to the northwest.

The Nord soil type extends to a depth of 72 inches; the soil column to a depth of 32 inches is composed of gray brown fine sandy loam and loam (Unified Soil Classification System symbol SM-ML) and a grayish brown loamy coarse sand and silt loam (Unified Soil Classification System symbol SM-ML) below that. The permeability of this Nord soil is in the range of from 5 to 15 feet per day.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. Groundwater is expected to be unconfined. It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the

immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The site has a high recharge potential. This conclusion is based on the presence of permeable surficial soils (Grangeville sandy loam and Nord fine sandy loam), its location near the axis of the Kaweah River fan, the probable presence of coarse-grained subsurface materials, and the apparent lack of any barriers to groundwater movement.

Flood Control Potential

This site has a low potential as a flood control facility because of its location and hydrogeologic setting.

Environmental Habitat Potential

The environmental habitat potential of this site is expected to be good. The potential for the Grangeville soil is similar to the Consolidated People's Ditch site. The potential of the Nord soil is show below:

Soil Type	Habitat	Good	Fair	Poor	Very Poor
Nord	Grass	X	-	-	-
	Legumes	X	-	-	-
	Herbaceous plants	X	-	-	-
	Hardwoods	-	X	-	-
	Shrubs	-	-	X	-
	Wetland plants	-	-	-	X
	Open-land wildlife	X	-	-	-
	Wetland wildlife	-	-	-	X

3.2.7 Alternative 7 - Kaweah Oaks (East) Side

The Kaweah Oaks (East) site is located between Deep Creek, on the northwest, and the Consolidated People's Ditch and Johnson Slough on the southeast. It lies directly north of Highway 198. It occupies about 170 acres in Sections 28 and 29, T18S, R26E, MDB&M. Ground elevation ranges from about 375 feet at the southwest corner at Highway 198 to about 380 feet at the northeast corner. This site is undeveloped and in its natural habitat. It has approximately the same elevation as the road. Part of the site is higher than the road on the southeast border. The land elevation would make it difficult to divert water from Deep Creek. Water would probably be diverted farther up stream in order to flood a bermed up area. The southern border of this site is the Consolidated People's Ditch. The Consolidated People's Ditch could conceivably divert water into this site if it was diverted further up stream and then piped over to the site.

Geology and Soils

The site is situated on Holocene alluvial fan deposits. Soils are composed of Grangeville sandy loam (drained phase) and Kaweah fine sandy loam similar to those at the Consolidated People's

Ditch site (see description for Alternative 1). The Grangeville soils are exposed near Deep Creek, while the Kaweah soils are exposed near Johnson Slough.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The site has a high recharge potential. This conclusion is based on the presence of permeable soils (Grangeville sandy loam and Nord fine sandy loam), its location near the axis of the Kaweah River fan, the probable presence of coarse-grained subsurface materials, and the apparent lack of any barriers to groundwater movement.

Flood Control Potential

This site has a low potential as a flood control facility because of its location and hydrogeologic setting.

Environmental Habitat Potential

The environmental habitat potential of this site is expected to be good. The Grangeville soil would be similar to the Consolidated People's Ditch site. The wildlife habitat potential of the Nord soil at this site is expected to be similar to the Kaweah Oaks (West) site (see description for Alternative 6).

3.2.8 Alternative 8 - Crocker Environmental Habitat Site

The Crocker Environmental Habitat site occupies a 5-acre parcel between the bank of the Lower Kaweah River and the Southern Pacific Railroad, near the center of Section 21, T18S, R26E, MDB&M. Ground elevation is at about 390 feet. This site appears to be fairly high in ground elevation compared with the surrounding housing and roads. The cost of developing this site for berming and maintenance would probably prove to be high when compared to the other alternatives (see Section 4, Tables 4.1, 4.2, 4.3 and 4.4).

Geology and Soils

The site is situated on Holocene alluvial fan deposits. Soils are composed of Grangeville sandy loam (drained phase) and similar to at the Consolidated People's Ditch site (see description for Alternative 1).

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. Groundwater is expected to be unconfined. It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the

groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The recharge potential of this site is expected to be low because of its small size.

Flood Control Potential

This site has a low potential as flood control facility because of its small size.

Environmental Habitat Potential

The environmental habitat potential of the this site is expected to be good, and similar to that at the Consolidated People's Ditch site (see description for Alternative 1).

3.2.9 Alternative 9 - Deep Creek Environmental Habitat Site

The Deep Creek Environmental Habitat site occupies a triangular parcel at the point of divergence of the Lower Kaweah River and Deep Creek; it is to the east of the Southern Pacific Railroad. It occupies about 15 acres in Section 21, T18S, R26E, MDB&M. Ground elevation is at about 390 feet. This site appears to be fairly high in ground elevation compared with the surrounding housing and roads. Habitat development would be minimal in this area. The cost of developing this site for berming and maintenance would probably prove to be similar to Alternative 8 and high when compared to the other alternatives (reference tables 4.1, 4.2, 4.3 and 4.4).

Geology and Soils

The site is situated on Holocene alluvial fan deposits. Most of the soils are composed of Grangeville sandy loam (drained phase); near the railroad, Nord fine sandy loam is exposed. The Grangeville soil is similar to that found at the Consolidated People's Ditch site and the Nord soil is similar to that found at the Kaweah Oaks (West) site.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. Groundwater is expected to be unconfined. It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The recharge potential of this site is expected to be low because of its small size.

Flood Control Potential

This site has a low potential as a flood control facility because of its small size.

Environmental Habitat Potential

The environmental habitat potential of this site is expected to be good, as it would be similar to that of the Kaweah Oaks (West) site (see description for Alternative 6).

3.2.10 Alternative 10 - Monrovia Reservoir Site

The Monrovia Reservoir site occupies a parcel of land along the St. Johns River immediately upstream from the notch in the Venice Hills through which the river passes. It occupies about 190 acres in Sections 9 and 16, T18S, R26E, MDB&M. The west side of the dam and reservoir would be adjacent to the Tulare Irrigation District (TID) canal. The Packwood Canal runs through the east side of the dam site and the reservoir area. Ground elevation ranges from about 385 feet at the dam site (ditch bottom) to about 395 feet at maximum pool. A dam and reservoir constructed at the Venice Hills site would interfere with a new residence built on the bottom of the channel area, worth approximately $120,000. The distance across to the abutments is approximately 1,500 feet. There are approximately 3 acres of walnuts immediately behind the house. The rest of the ground is open and would be a good reservoir site. The flood area could include TID's ditch or be limited to just inside of the ditch bank. The ditch bank is about 4 feet high above ground level. Most of the flood plain area is now vacant ground. The area could flood up to Rocky Ford without causing much damage in the flood plain area. The northerly end would be bermed up 2 to 3 feet to save some citrus on the south side of Venice Hills. This alternative would adversely impact Monrovia (i.e. changes in micro climate, possible soil pathogen problems).

Geology and Soils

The reservoir would be situated on Holocene alluvial fan deposits; the dam would be founded on ultrabasic rocks. Soils in the reservoir area are composed of Grangeville sandy loam (drained phase) similar to those at the Consolidated People's Ditch site (see description for Alternative 1). The bed of the St. Johns River is composed of riverwash.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. Groundwater is expected to be present based on the existence of several dwelling units in the reservoir area. It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

Very little recharge would be afforded to the fan area west of the Venice Hills due to the bedrock barrier formed by the Venice Hills. Hence, the recharge potential for this site is very low, unless water could be regulated for late spring releases into the St. Johns River.

Flood Control Potential

The reservoir site is ideally located to assist in flood control for the St. Johns River. It would also make a good detention reservoir. Thus, it has a high flood control potential, but may not be effective for Visalia. Visalia's greatest needs are on the Kaweah River. It is expected that there may be little leakage of detention waters to groundwater. Groundwater percolation would be through regulated releases for percolation downstream in the St. Johns River.

Dam and Reservoir Conditions

A dam constructed at the Venice Hills narrows would be founded on ultrabasic rocks. This type of rock generally does not act as a reliable foundation rock due to in situ fracture permeability and difficulties in constructing a subsurface cutoff wall.

Division 3 of the California Water Code identifies non-jurisdictional sizes of dams and reservoirs as shown below. Dams and reservoirs which exceed any of these criteria are under the jurisdiction of the California Division of Safety of Dams.

Non-jurisdictional dams and reservoirs:

Dams:
1. Not over 6 feet in height, unlimited capacity.
2. Not over 25 feet in height, maximum capacity 50 acre feet.

Reservoirs: Not over 15 acre feet capacity, unlimited dam height.

Environmental Habitat Potential

The environmental habitat potential of the Monrovia Reservoir site is expected to be fair to good, as it would be similar to that at the Consolidated People's Ditch site (see description for Alternative 1) as modified by an aquatic biotic community that would be attracted by the presence of the body of water created by the reservoir.

3.2.11 Alternative 11 - LSID (Northwest) Site

The Lindsay/Strathmore Irrigation District (LSID)-Northwest site occupies 230 acres in Sections 15 and 22, T18S, R26E, MDB&M. Its south boundary is the Kaweah River, a portion of its northwest boundary is at Road 188. Ketchum Ditch goes through the northwest corner of the site; and Lane Slough runs diagonally southwest through the site. Ground elevation ranges from about 390 feet at the southwestern edge to about 400 feet at its northeastern corner. All LSID sites are owned by the Lindsay-Strathmore Irrigation District. The ground elevation is approximately the same as Road 196. Water diversion onto this site for flood control would be difficult. Possibly water could be diverted into Lane Slough from the St. Johns River or Ketchum Ditch.

Geology and Soils

The LSID-Northwest site is situated on Holocene alluvial fan deposits. Soils are composed of Grangeville sandy loam (drained phase) and Kaweah fine sandy loam, similar to those at the Consolidated People's Ditch site (see description for Alternative 1). The Kaweah soils are exposed in the northern part of the site; Grangeville soils are exposed in the remainder of the site.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. There are indications that groundwater has been developed at the site for domestic and/or agricultural purposes. Groundwater conditions are expected to be similar to those at the Consolidated People's Ditch site (see description for Alternative 1). It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The recharge potential of the LSID-Northwest site is expected to be high, and similar to that of the Consolidated People's Ditch site (see description for Alternative 1).

Flood Control Potential

This site has a low potential as a flood control facility because of its location and hydrogeologic setting.

Environmental Habitat Potential

The environmental habitat potential of the LSID-Northwest site is expected to be good, as it would be similar to that of the Consolidated People's Ditch site (see description for Alternative 1).

3.2.12 Alternative 12 - LSID (Farmed Land) Site

The LSID-Farmed Land site occupies 120 acres in the southwest quarter of Section 11, T18S, R26E, MDB&M. Its west boundary is Road 188; Lane Slough runs diagonally across the site. Ketchum Ditch runs along its northwest corner. Ground elevation ranges from about 400 feet at the southwestern corner to about 410 feet at its northeastern corner. This site ground elevation is approximately the same as Road 188. Detention or retention on this site would not be a compatible use. The ground is currently being farmed by the Shannon family in field crops.

Geology and Soils

The LSID-Farmed Land site is situated on Holocene alluvial fan deposits. Most of the soils are composed of Grangeville sandy loam (drained phase) similar to that at the Consolidated People's Ditch site. A few acres of Tujunga loamy sand occur next to Road 188 at the northwest corner or the site. The Tujunga soil column is composed of brown loamy sand (Unified Soil Classification System symbol SM) to a depth of 72 inches. Its permeability is in the range of from 15 to 50 feet per day.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. There are indications that groundwater has been developed at the site for agricultural uses. Groundwater conditions are expected to be similar to those at the

Consolidated People's Ditch site (see description for Alternative 1). It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The recharge potential of the LSID-Farmed Land site is expected to be high, and similar to the Consolidated People's Ditch site (see description for Alternative 1).

Flood Control Potential

This site has a low potential as a flood control facility because of its location and hydrogeologic setting.

Environmental Habitat Potential

The overall environmental habitat potential of the LSID-Farmed Land site is expected to be good, as the Grangeville soils are similar to those at the Consolidated People's Ditch site (see description for Alternative 1). The U.S. Soil Conservation Service has not formally mapped the wildlife habitat potential of the Tujunga soils. However, based on verbal discussions with their staff, the Tujunga Soils at this site should be somewhat better than shown for Tujunga Soils at the SK Ranch site (see description for Alternative 14).

3.2.13 Alternative 13 - Yokohl Creek Site

The Yokohl Creek site occupies 80 acres in Section 14, T18S, R26E, MDB&M. It is located to the north of the Lower Kaweah River and immediately east of the LSID-Northeast site. Ground elevation ranges from about 405 feet at the southwestern corner to about 410 feet at its northeastern corner.

Geology and Soils

The Yokohl Creek site is situated on Holocene alluvial fan deposits. Soils are composed of Grangeville sandy loam (drained phase) and Kaweah fine sandy loam, similar to the Consolidated People's Ditch site. The Kaweah soils are exposed in the central portion of the site. Grangeville soils are exposed in the remainder of the site.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. Groundwater conditions are expected to be similar to those at the Consolidated People's Ditch site (see description for Alternative 1). It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The recharge potential of the Yokohl Creek site is expected to be high and similar to the Consolidated People's Ditch site.

Flood Control Potential

This site has a low potential as a flood control facility because of its location and hydrogeologic setting.

Environmental Habitat Potential

The environmental habitat potential of the Yokohl Creek site is expected to be good, and similar to the Consolidated People's Ditch site (see description for Alternative 1).

3.2.14 Alternative 14 - S. K. Ranch Site

The S. K. Ranch site comprises 300 acres in Sections 7 and 18, T18S, R27E, MDB&M. The site is situated to the south of the Lower Kaweah River and to the east of Highway 245 (Road 212). Site elevations range from 420 feet at Highway 245 to about 430 feet at the east edge of the property. This site could be used for a detention pond, but would require berming the property all the way around 2 to 3 feet in height, which could conceivably put it higher than Highway 245. East of Spruce, groundwater appears to move south and away from Visalia. Therefore, this may not be a prime site.

Geology

The site is situated on Holocene alluvial fan deposits near the head of the Kaweah River fan. Being near the apex of an alluvial fan, it is expected that coarse grained materials, such as sand, gravel, and boulders would be present in the subsurface. These subsurface materials represent now buried stream courses that have built the alluvial fan over geologic time, and they now act as conduits for the movement of groundwater, which percolates from the fan head and moves in a Southwesterly toward the City of Exeter.

Soils

Three soil types are present at the S. K. Ranch site. Most of the property is underlain by Grangeville silt loam (drained phase). The upper 14 inches of the Grangeville soil column is composed of a grayish brown silt loam (Unified Soil Classification System symbol ML); from that depth to a depth of 64 inches, is a stratified brown, grayish brown, and light brownish gray silt loam, loam, loamy sand, and sandy loam (Unified Soil Classification System symbol SM). This Grangeville soil has a permeability in the range of 1 to 5 feet per day from the ground surface to depth of 14 inches and a permeability in the range of 5 to 15 feet per day in the depth range from 14 to 64 inches.

The extreme northeast portion of the property is underlain by Tujunga sand. The upper 8 inches of the Tujunga soil column is composed of a light brownish gray sand (Unified Soil Classification System symbols SW-SM-SP); from that depth to a depth of 60 inches, is a grayish brown and very pale brown sand and coarse sand (Unified Soil Classification System symbols SW-SP-SM). This Tujunga soil has a permeability in the range of 15 to 50 feet per day from the ground surface to depth of 60 inches.

The southern and southeastern extremity of the property is underlain by San Joaquin loam. The typical surface layer is a brown and reddish brown loam (Unified Soil Classification System symbols CL-ML) about 13 inches thick; it has a permeability in the range of from 1.5 to 5 feet per day. The upper part of the subsoil, to a depth of 20 inches, is a reddish brown sandy clay loam and clay (Unified Soil Classification System symbols SC-CL); it has a permeability in the range of 0.5 to 1.5 feet per day. The lower subsoil, to a depth of 25 inches, is similar but has a permeability that is less than 0.15 feet per day. Below the subsoil, to a depth of 43 inches, is a layer of indurated, impermeable hardpan. Below this hardpan layer, to a depth of 78 inches is a brown, stratified sandy loam and loam (Unified Soil Classification System symbols SM-SC) that has a permeability in the range of from 0.15 to 0.5 feet per day.

Groundwater

As discussed in Section 2.4.2, Part One included only a reconnaissance-level investigation of overall groundwater conditions in the study area, and did not analyze detailed site-specific information. Groundwater conditions are expected to be similar to those at the Consolidated People's Ditch site (see description for Alternative 1). It is anticipated that a gradient would be quickly established between the water surface elevation in the surface water channel and the groundwater table on the site. Therefore, the groundwater level at the site, other than in the immediate bank storage area paralleling the channel, would be expected to be similar to the overall groundwater table in the area.

Recharge Potential

The site may be developed into a medium groundwater recharge facility, as long as the facilities do not include any zones of San Joaquin loam with its thick zone of impermeable hardpan. However, its location, east of Spruce Road, may limit recharge benefits to the City of Visalia.

Flood Control Potential

This site has a high potential as a flood control facility because of its location and hydrogeologic setting.

Environmental Habitat Potential

Environmental habitat potentials for Grangeville silt loam (drained phase), for Tujunga sand, and for San Joaquin loam are estimated as fair and shown below:

Soil Type	Habitat	Good	Fair	Poor	Very Poor
Grangeville	Grass	X	-	-	-
	Legumes	X	-	-	-
	Herbaceous plants	X	-	-	-
	Hardwoods	X	-	-	-
	Shrubs	X	-	-	-
	Wetland plants	-	X	-	-
	Open-land wildlife	X	-	-	-
	Wetland wildlife	-	-	X	-
Tujunga	Grass	-	X	-	-
	Legumes	-	X	-	-
	Herbaceous plants	-	X	-	-
	Hardwoods	-	X	-	-
	Shrubs	-	X	-	-
	Wetland plants	-	-	-	X
	Open-land wildlife	-	X	-	-
	Wetland wildlife	-	-	-	X
San Joaquin	Grass	X	-	-	-
	Legumes	X	-	-	-
	Herbaceous plants	-	X	-	-
	Hardwoods	-	X	-	-
	Shrubs	-	X	-	-
	Wetland plants	-	X	-	-
	Open-land wildlife	-	X	-	-
	Wetland wildlife	-	X	-	-

Part One - Section 4
Alternatives Evaluation and Ranking

4.1 Evaluation Methodology

Based on the information presented in Section 3, a determination was made of relative values for groundwater recharge, flood control, and environmental habitat at the 14 alternative sites. The ranking of alternatives was made taking into consideration *flood control, environmental habitat, ground water recharge* and *annual storage cost* per acre foot. A maximum of 3 points (low = 1, medium = 2, high = 3) was given for flood control, environmental habitat and ground water recharge for a total of 9 points maximum. The alternatives were then ranked from 1 through 14 based on storage cost per acre-foot from lowest cost (1) to highest cost (14). A total point value for each alternative was calculated by multiplying the sum of the points for flood control, environmental habitat, and groundwater recharge by the inverse of the cost ranking.

The overall ranking was determined from the total point value, with the highest ranked alternative having the most points and the lowest ranked alternative the least points. This method might be revised by placing greater or less emphasis on any of the 4 parameters evaluated. Appendix E contains the calculations for the ranking analysis.

4.2 Evaluation Results

The evaluation criteria and rankings of the 14 alternative sites are summarized on Tables 4-1, 4-2, 4-3 and 4-4. In addition, the tables show the preliminary estimated costs for facilities and operations. These cost estimates use different parameters for interest on investment and project facilities amortization time. Appendix D contains calculations for costs of facilities.

- Table 4-1 is evaluated using 4% interest and 15 year facilities amortization (land 30 years)
- Table 4-2 is evaluated using 6% interest and 30 year facilities amortization (land 30 years)
- Table 4-3 is evaluated using 6% interest and 15 year facilities amortization (land 30 years)
- Table 4-4 is evaluated using 6% interest and 30 year facilities amortization (land 30 years)

The ranking of the alternatives did not significantly change with differences in interest and amortization. However, this variation of interest and amortization identifies the sensitivity of the cost of each alternative by varying the interest and amortization periods.

TABLE 4-1

EVALUATION OF ALTERNATIVES (PART ONE)
4% INTEREST WITH 15 YEAR AMORTIZATION

Alternative No. and Site Name	Surface Area (AC)	Pond Depth (FT.)	Storage Capacity (A.F.)	Values For			Property Value 3/			Facilities Cost 4/		Operation Costs	Total Annual & Oper. Cost	Storage Cost $/A.F. per year	Alts. Ranking 5/
				Recharge Benefits	Flood Control	Environ. Habitat	$/AC	Cost	Annual Cost	Cost	Annual Cost				
1. Consolidated People's Ditch	130	5	750	HIGH	HIGH	GOOD	4,000	520,000	46,700	32,500	2,920	2,000	51,610	69	1
2. St. Johns River	40	2	80	HIGH	LOW	POOR	----	----	----	----	----	38,000	38,000	475	14
3. LSID (N.E.)	140	2	280	HIGH	MEDIUM	GOOD	4,000	560,000	50,300	30,700	2,760	2,000	55,060	197	7
4. LSID (S.W.)	250	3	750	HIGH	MEDIUM	GOOD	5,000	1,250,000	112,400	56,000	5,030	3,000	120,430	160	4
5. LSID (S.E.)	80	3	240	HIGH	MEDIUM	GOOD	4,000	320,000	28,700	27,800	2,500	2,500	33,700	140	3
6. Kaweah Oaks (West)	150	2	300	HIGH	LOW	GOOD	4,000	600,000	54,000	46,300	4,160	3,000	61,160	204	8
7. Kaweah Oaks (East)	170	3	510	HIGH	LOW	GOOD	4,000	680,000	61,200	51,000	4,590	3,000	68,790	134	2
8. Crocker Envir. Hab.	5	2	10	LOW	LOW	GOOD	4,000	20,000	1,800	11,000	990	500	3,290	329	13
9. Deep Creek Envir. Hab.	15	2	30	LOW	LOW	GOOD	4,000	60,000	5,400	15,650	1,410	600	7,410	247	12
10. Monrovia Res.	190	5	950	LOW	HIGH	FAIR	6,000	1,140,000	102,500	201,000	18,080	10,000	130,580	137	5
11. LSID (N.W.)	230	2	460	HIGH	LOW	GOOD	4,000	920,000	82,700	45,900	4,130	3,000	89,830	195	6
12. LSID (Farmed Land)	120	2	240	HIGH	LOW	GOOD	5,000	600,000	54,000	28,240	2,540	2,500	59,040	246	11
13. Yokohl Creek	80	2	160	HIGH	LOW	GOOD	5,000	400,000	36,000	28,440	2,560	2,500	41,060	257	10
14. SK Ranch	300	2	600	MEDIUM	HIGH	FAIR	5,000	1,500,000	134,900	32,500	2,920	3,000	140,820	234	9

1/ All figures and values are rough estimates
2/ Land & Facilities amortization - 15 years, 4% interest, (crf) = 0.05783
3/ Land Cost Est. Figures Revised: July 23, 1993
4/ Ref Appendix "D" - Calculations
5/ Ref Appendix "E" - for Ranking Analysis

TABLE 4-2
EVALUATION OF ALTERNATIVES (PART ONE)
4% INTEREST WITH 30 YEAR PROPERTY AMORTIZATION (FACILITIES 15 YEARS

Alternative No. and Site Name	Surface Area (AC)	Pond Depth (FT.)	Storage Capacity (A.F.)	Values For			Property Value 3/			Facilities Cost 4/		Operation Costs	Total Annual & Oper. Cost	Storage Cost $/A.F. per year	Alts. Ranking 5/
				Recharge Benefits	Flood Control	Environ. Habitat	$/AC	Cost	Annual Cost	Cost	Annual Cost				
1. Consolidated Peoples Ditch	130	5	750	HIGH	HIGH	GOOD	4,000	520,000	30,070	32,500	2,920	2,000	34,990	46	1
2. St. Johns River	40	2	80	HIGH	LOW	POOR	----	----	----	----	----	38,000	38,000	475	14
3. LSID (N.E.)	140	2	280	HIGH	MEDIUM	GOOD	4,000	560,000	32,380	30,700	2,760	2,000	37,140	132	6
4. LSID (S.W.)	250	3	750	HIGH	MEDIUM	GOOD	5,000	1,250,000	72,290	56,000	5,030	3,000	80,320	107	4
5. LSID (S.E.)	80	3	240	HIGH	MEDIUM	GOOD	4,000	320,000	18,500	27,800	2,500	2,500	23,500	98	2
6. Kaweah Oaks (West)	150	2	300	HIGH	LOW	GOOD	4,000	600,000	34,700	46,300	4,160	3,000	41,860	140	8
7. Kaweah Oaks (East)	170	3	510	HIGH	LOW	GOOD	4,000	680,000	39,300	51,000	4,590	3,000	46,890	92	3
8. Crocker Envir. Hab.	5	2	10	LOW	LOW	GOOD	4,000	20,000	1,160	11,000	990	500	2,650	265	13
9. Deep Creek Envir. Hab.	15	2	30	LOW	LOW	GOOD	4,000	60,000	3,470	15,650	1,410	600	5,480	183	12
10. Monrovia Res.	190	5	950	LOW	HIGH	FAIR	6,000	1,140,000	65,930	201,000	18,080	10,000	94,010	99	5
11. LSID (N.W.)	230	2	460	HIGH	LOW	GOOD	4,000	920,000	53,200	45,900	4,130	3,000	60,330	131	7
12. LSID (Farmed Land)	120	2	240	HIGH	LOW	GOOD	5,000	600,000	34,700	28,240	2,540	2,500	39,740	166	10
13. Yokohl Creek	80	2	160	HIGH	LOW	GOOD	5,000	400,000	23,130	28,440	2,560	2,500	28,190	176	11
14. SK Ranch	300	2	600	MEDIUM	HIGH	FAIR	5,000	1,500,000	86,740	32,500	2,920	3,000	92,660	154	9

1/ All figures and values are rough estimates
2/ Land amortization - 30 years, 4% interest, (crf) = 0.05783; Facilities - 15 years, 4% interest, (crf) = 0.08994
3/ Land Cost Est. Figures Revised: July 23, 1993
4/ Ref Appendix "D" - Calculations
5/ Ref Appendix "E" - for Ranking Analysis

TABLE 4-3
EVALUATION OF ALTERNATIVES (PART ONE)
6% INTEREST WITH 15 YEAR AMORTIZATION

Alternative No. and Site Name	Surface Area (AC)	Pond Depth (FT.)	Storage Capacity (A.F.)	Values For			Property Value 3/			Facilities Cost 4/		Operation Costs	Total Annual & Oper. Cost	Storage Cost $/A.F. per year	Alts. Ranking 5/
				Recharge Benefits	Flood Control	Environ. Habitat	$/AC	Cost	Annual Cost	Cost	Annual Cost				
1. Consolidated Peoples Ditch	130	5	750	HIGH	HIGH	GOOD	4,000	520,000	53,540	32,500	3,340	2,000	58,880	79	1
2. St. Johns River	40	2	80	HIGH	LOW	POOR	----	----	----	----	----	38,000	38,000	475	14
3. LSID (N.E.)	140	2	280	HIGH	MEDIUM	GOOD	4,000	560,000	57,660	30,700	3,160	2,000	62,820	224	6
4. LSID (S.W.)	250	3	750	HIGH	MEDIUM	GOOD	5,000	1,250,000	128,700	56,000	5,770	3,000	137,470	183	4
5. LSID (S.E.)	80	3	240	HIGH	MEDIUM	GOOD	4,000	320,000	32,950	27,800	2,860	2,500	38,310	160	3
6. Kaweah Oaks (West)	150	2	300	HIGH	LOW	GOOD	4,000	600,000	61,780	46,300	4,770	3,000	69,550	231	9
7. Kaweah Oaks (East)	170	3	510	HIGH	LOW	GOOD	4,000	680,000	70,010	51,000	5,250	3,000	78,260	153	2
8. Crocker Envir. Hab.	5	2	10	LOW	LOW	GOOD	4,000	20,000	2,060	11,000	1,130	500	3,690	369	13
9. Deep Creek Envir. Hab.	15	2	30	LOW	LOW	GOOD	4,000	60,000	6,180	15,650	1,610	600	8,390	279	11
10. Monrovia Res.	190	5	950	LOW	HIGH	FAIR	6,000	1,140,000	117,370	201,000	20,690	10,000	148,060	156	5
11. LSID (N.W.)	230	2	460	HIGH	LOW	GOOD	4,000	920,000	94,720	45,900	4,730	3,000	102,450	223	7
12. LSID (Farmed Land)	120	2	240	HIGH	LOW	GOOD	5,000	600,000	61,780	28,240	2,910	2,500	67,190	280	10
13. Yokohl Creek	80	2	160	HIGH	LOW	GOOD	5,000	400,000	41,180	28,440	2,930	2,500	46,610	291	12
14. SK Ranch	300	2	600	MEDIUM	HIGH	FAIR	5,000	1,500,000	154,440	32,500	3,350	3,000	160,790	267	8

1/ All figures and values are rough estimates
2/ Land & Facilities amortization - 15 years, 6% interest, (crf) = 0.10296
3/ Land Cost Est. Figures Revised: July 23, 1993
4/ Ref Appendix "D" - Calculations
5/ Ref Appendix "E" - for Ranking Analysis

TABLE 4-4
EVALUATION OF ALTERNATIVES (PART ONE)
6% INTEREST WITH 30 YEAR PROPERTY AMORTIZATION (FACILITIES 15 YEARS

Alternative No. and Site Name	Surface Area (AC)	Pond Depth (FT.)	Storage Capacity (A.F.)	Values For			Property Value 3/			Facilities Cost 4/		Operation Costs	Total Annual & Oper. Cost	Storage Cost $/A.F. per year	Alts. Ranking 5/
				Recharge Benefits	Flood Control	Environ. Habitat	$/AC	Cost	Annual Cost	Cost	Annual Cost				
1. Consolidated Peoples Ditch	130	5	750	HIGH	HIGH	GOOD	4,000	520,000	37,780	32,500	3,340	2,000	43,120	57	1
2. St. Johns River	40	2	80	HIGH	LOW	POOR	----	----	----	----	----	38,000	38,000	475	14
3. LSID (N.E.)	140	2	280	HIGH	MEDIUM	GOOD	4,000	560,000	40,680	30,700	3,160	2,000	45,840	164	6
4. LSID (S.W.)	250	3	750	HIGH	MEDIUM	GOOD	5,000	1,250,000	90,810	56,000	5,770	3,000	99,580	133	4
5. LSID (S.E.)	80	3	240	HIGH	MEDIUM	GOOD	4,000	320,000	23,250	27,800	2,860	2,500	28,610	119	2
6. Kaweah Oaks (West)	150	2	300	HIGH	LOW	GOOD	4,000	600,000	43,590	46,300	4,770	3,000	51,310	171	8
7. Kaweah Oaks (East)	170	3	510	HIGH	LOW	GOOD	4,000	680,000	49,400	51,000	5,250	3,000	57,650	113	3
8. Crocker Envir. Hab.	5	2	10	LOW	LOW	GOOD	4,000	20,000	1,450	11,000	1,130	500	3,080	308	13
9. Deep Creek Envir. Hab.	15	2	30	LOW	LOW	GOOD	4,000	60,000	4,360	15,650	1,610	600	6,570	219	12
10. Monrovia Res.	190	5	950	LOW	HIGH	FAIR	6,000	1,140,000	82,820	201,000	20,690	10,000	113,510	119	5
11. LSID (N.W.)	230	2	460	HIGH	LOW	GOOD	4,000	920,000	66,840	45,900	4,730	3,000	74,570	162	7
12. LSID (Farmed Land)	120	2	240	HIGH	LOW	GOOD	5,000	600,000	43,590	28,240	2,910	2,500	49,000	204	10
13. Yokohl Creek	80	2	160	HIGH	LOW	GOOD	5,000	400,000	29,060	28,440	2,930	2,500	34,490	216	11
14. SK Ranch	300	2	600	MEDIUM	HIGH	FAIR	5,000	1,500,000	108,980	32,500	3,350	3,000	114,830	191	9

1/ All figures and values are rough estimates
2/ Land amortization - 30 years, 6% interest, (crf) = 0.07265; Facilities - 15 years, 6% interest, (crf) = 0.10296
3/ Land Cost Est. Figures Revised: July 23, 1993
4/ Ref Appendix "D" - Calculations
5/ Ref Appendix "E" - for Ranking Analysis

Part One - Section 5
Summary and Recommendations

5.1 Summary of Alternative Rankings

Table 5-1 presents a summary of the alternatives rankings discussed in Section 4. The alternatives are listed according to their ranking order starting with the top-ranked alternative.

Values for groundwater recharge potential range from HIGH to GOOD, and LOW. Ten sites have a HIGH recharge potential, that is, the cursory examination reveals that these sites probably would act as acceptable recharge sites if confirmed by exploration. One site has a MEDIUM potential, that is, it appears to have some hydrogeologic problems, but it may be adequate if confirmed by exploration. Three sites have a LOW recharge potential, as judged principally by their small area and because of a geologic setting upstream from impermeable rock.

Values for flood control potential range from HIGH to MEDIUM, and LOW. Three sites have a HIGH potential for flood control, three sites have a MEDIUM potential, and eight sites have a LOW potential. Determination of potential was derived from analysis of geographic, geologic, soils, and other data.

Values for environmental habitat potential ranges are GOOD, FAIR and POOR. Eleven sites have a GOOD environmental habitat potential, two sites have a FAIR potential, and one site has a POOR potential. Habitat potentials were determined from soils data provided by the U.S. Soil Conservation Service.

The rankings of the alternative sites from the Part One water resources evaluation are summarized below.

Ranking No.	Alternative No.	Description
1	1	Consolidated People's Ditch
2	5	LSID (S.E.)
3	7	Kaweah Oaks (East)
4	4	LSID (S.W.)
5	10	Monrovia Reservoir
6	3	LSID (N.E.)
7	11	LSID (N.W.)
8	6	Kaweah Oaks (West)
9	14	SK Ranch
10	12	LSID (Farmed Land)
11	13	Yokohl Creek
12	9	Deep Creek Environmental Habitat
13	8	Crocker Environmental Habitat
14	2	St. Johns River

TABLE 5-1
SUMMARY OF ALTERNATIVE RANKINGS (Part One)

Overall Ranking	Alternative No. and Site Name	Surface Area (AC)	Pond Depth (FT.)	Storage Capacity (A.F.)	Values For			Storage Cost $/A.F. per year (4%, 15 YR)	Storage Cost $/A.F. per year (4%, 30 YR)	Storage Cost $/A.F. per year (6%, 15 YR)	Storage Cost $/A.F. per year (6%, 30 YR)
					Recharge Benefits	Flood Control	Environ. Habitat				
1	1. Consolidated People's Ditch	130	5	750	HIGH	HIGH	GOOD	69	46	79	57
2	5. LSID (S.E.)	80	3	240	HIGH	MEDIUM	GOOD	140	98	160	119
3	7. Kaweah Oaks (East)	170	3	510	HIGH	LOW	GOOD	134	92	153	113
4	4. LSID (S.W.)	250	3	750	HIGH	MEDIUM	GOOD	160	107	183	133
5	10. Monrovia Res.	190	5	950	LOW	HIGH	FAIR	137	99	156	119
6	3. LSID (N.E.)	140	2	280	HIGH	MEDIUM	GOOD	197	132	224	164
7	11. LSID (N.W.)	230	2	460	HIGH	LOW	GOOD	195	131	223	162
8	6. Kaweah Oaks (West)	150	2	300	HIGH	LOW	GOOD	204	140	231	171
9	14. SK Ranch	300	2	600	MEDIUM	HIGH	FAIR	234	154	267	191
10	12. LSID (Farmed Land)	120	2	240	HIGH	LOW	GOOD	246	166	280	204
11	13. Yokohl Creek	80	2	160	HIGH	LOW	GOOD	257	176	291	216
12	9. Deep Creek Envir. Hab.	15	2	30	LOW	LOW	GOOD	247	183	279	219
13	8. Crocker Envir. Hab.	5	2	10	LOW	LOW	GOOD	329	265	369	308
14	2. St. Johns River	40	2	80	HIGH	LOW	POOR	475	475	475	475

5.2 Recommendations

Further data analyses and field exploratory work will be required in order to prove the capability of any particular site. Regardless of site(s) chosen, the following hydrogeologic approach should be taken:

- *Water Wells.* Canvass the area within one mile of each chosen site to identify any water wells. Note the use of such wells (domestic, agricultural, idle, abandoned, etc.). Obtain logs of as many of these wells as possible. Well logs are available through KDWCD, and are confidential (California Water Code Section 13752). Additional pertinent information on this and following recommendations will be presented in *Parts Two and Three* of this study.

- *Groundwater Levels.* Determine if KDWCD or water purveyor is currently measuring groundwater levels within one mile of a chosen site. If there are such wells, obtain historic water level data, and obtain current data as they are developed. Obtain pre-project biennial (spring and fall) water level measurements. The measurement program should be continued during operation of the facility for each chosen site.

- *Groundwater Exploration.* Select three to five locations for groundwater test holes/monitoring wells at each chosen site. Test holes should be drilled to a depth of about 100 feet. They should be completed as permanent groundwater monitoring facilities through the installation of casing and well screen. After completion, groundwater levels should be obtained monthly for the first year, then semi-annually thereafter.

- *Geophysical Exploration.* Depending on the results of the drilling program, it may be advantageous to perform some geophysical seismic or electrical resistivity surveys. The surveys would help to identify subsurface zones which could inhibit the downward percolation of recharged water.

- *Special Problems.* Utilization of the Monrovia Reservoir site, if considered further, will present some special problems. These relate to providing a competent foundation for the dam at the Venice Hills. It will be necessary to run some geophysical lines at the dam site in order to determine the depth of riverwash and related surficial materials. It also will be necessary to drill a number of test holes on each abutment as well as in the channel area to determine the amount of stripping that will be necessary as well as to determine the competency of the ultrabasic foundation rock. Such exploratory work would be required by the California Division of Safety of Dams if the dam and reservoir are of jurisdictional size.

City of Visalia
Kaweah Delta Water Conservation District
Tulare County

Kaweah River Delta Corridor Enhancement Study

PART TWO - ENVIRONMENTAL HABITAT

June 1993
Revised July 1993

Part Two - Section 1
Introduction

1.1 Background Information

Riparian woodland, simply stated, is the vegetation that grows along the banks of rivers and streams. In the Central Valley, the availability of water in riparian habitat creates a microhabitat that permits water-loving deciduous trees to exist. These trees and shrubs are more closely related to the species that are found in the deciduous forests of the East than to the drought tolerant species that have evolved in California's mediterranean climate. Elna Bakker offers an excellent description of riparian woodland in her book *An Island Called California*:

> Riparian vegetation is often rampant in growth. Some of the temptation to refer to it as a gallery forest is inspired by its junglelike appearance, particularly in summer when wild grape and clematis hang in thick green curtains reminiscent of the lianas in rainforest clearings. Unless one follows trails it is almost impossible to penetrate such profligacy of plant life. Not only are the trees so crowded that the foliage of one merges with that of its neighbor without interruption, but also the underlayers are savage conglomerations of fallen limbs and other debris, berry vines, wild rose snarls, poison oak patches, rank herbaceous growth and saplings. Away from the river the woods usually open out into more parklike stands.

The beltlike nature of riparian corridors creates two ecotones (zones of transition between different habitat types) within a very small area. One ecotone is the transition zone between the aquatic habitat and the adjacent riparian vegetation. The second ecotone occurs where the riparian woodland comes into contact with adjacent upland habitat of grassland or oak woodland. High species diversity is often found along ecotones because many animals may use one habitat for nesting or refuge and another for foraging.

Studies of the historic extent of riparian forest indicate that 920,000 acres of this type of habitat once covered the floor of the Sacramento and San Joaquin Valleys (Faber and Holland, 1988). Land adjacent to the rivers was highly desirable to early settlers and much of the Valley's riparian forests were quickly converted to farmland and townsites. Municipal, industrial and agricultural uses have also altered stream channels and in-stream flows. By the mid 1970's, approximately 12,000 acres (about 1 percent) of relatively high quality riparian habitat still existed in the Central Valley (Faber and Holland, 1988). The loss of habitat has also caused a severe decline in the populations of many species that rely on riparian woodland for all or part of their life cycle resulting in their listing as threatened or endangered.

The Kaweah River delta supports significant remnants of Great Valley valley oak riparian forest. This plant community is found only in California's Central Valley and is in serious decline. It is second only to Southern California's Engelman oak riparian forest in it's threatened status. A prime example of the valley oak riparian forest community is found on the Kaweah Oaks Preserve. The 340 acre preserve is located on a distributary of the Lower Kaweah River and is owned and managed by The Nature Conservancy.

The presence of valley oak riparian forest is dependent on a number of factors; the most important being appropriate hydrology. This plant community can and should be flooded periodically as part of its natural biology. The impoundment of flows behind Terminus Dam in 1963 has partially regulated flood flows along the Kaweah River and created additional seasonal storage for irrigation resulting in reduced flooding of riparian woodland communities. Therefore, detention of surface water flows for groundwater recharge can benefit the remnants of valley oak riparian forest along the Kaweah and St. Johns Rivers. This provides the opportunity to accomplish two goals in a single project: groundwater recharge for urban and agricultural uses and preservation of a significant and threatened plant community.

1.2 Project Description

The City of Visalia, the County of Tulare, and the Kaweah Delta Water Conservation District (KDWCD) have formed a task force to address the opportunities that exist for integration of water resource management with the enhancement of native riparian plant and animal communities in the delta of the Kaweah River. A grant was received from the Wildlife Conservation Board to conduct a feasibility study for conjunctive use projects where groundwater recharge, peak flood storage and enhancement of riparian habitat could be achieved simultaneously on the same sites.

The waters of the Kaweah and St. Johns Rivers have historically been committed to surface irrigation and groundwater recharge for municipal, industrial and agricultural uses. Conversion of agricultural land to urban uses in the Visalia area have created a need for recharge of groundwater used for municipal and industrial uses. Increased amounts of stormwater runoff from city streets will exceed the capacity of the stream channels within the City, creating a need for off-stream storage of floodwaters upstream from Visalia. To benefit the City, these detention and recharge basins need to be located east of the urbanized areas along the river corridor. The feasibility study will identify sites where detention of surface water flows could enhance and expand riparian habitat while allowing for management of urban storm flows and expansion of groundwater recharge efforts.

The study is to be conducted in three parts; Part One focused on the water resource issues, and Part Two addresses the habitat and wildlife issues and follows the completion of Part One. Camp Dresser & McKee (CDM) was engaged to perform the Part One study and completed their investigation in April, 1993. KAS Consultants (KASCO) was contracted to prepare Part Two of the study: an inventory of the biotic resources in the area and identification of specific areas within the Kaweah River delta that are suitable for habitat expansion and enhancement.

1.3 Objectives and Technical Approach

The primary objective of the Part Two study will be to identify specific sites where detention flows could enhance and expand riparian forest habitat and the plant and wildlife species that it supports. Secondary objectives include identification of potential sites for long term protection and/or acquisition; compilation of an inventory of plant and animal resources found in the study area; and to identify opportunities for passive recreation.

In order to meet the objectives of the Part Two study a number of tasks were undertaken to characterize the biotic resources of the Kaweah River Corridor. The study focuses on the remnants of Great Valley valley oak riparian forest and valley oak woodland natural

communities and the many indigenous species that it supports. These tasks are outline below and discussed in greater detail in Section 2.0:

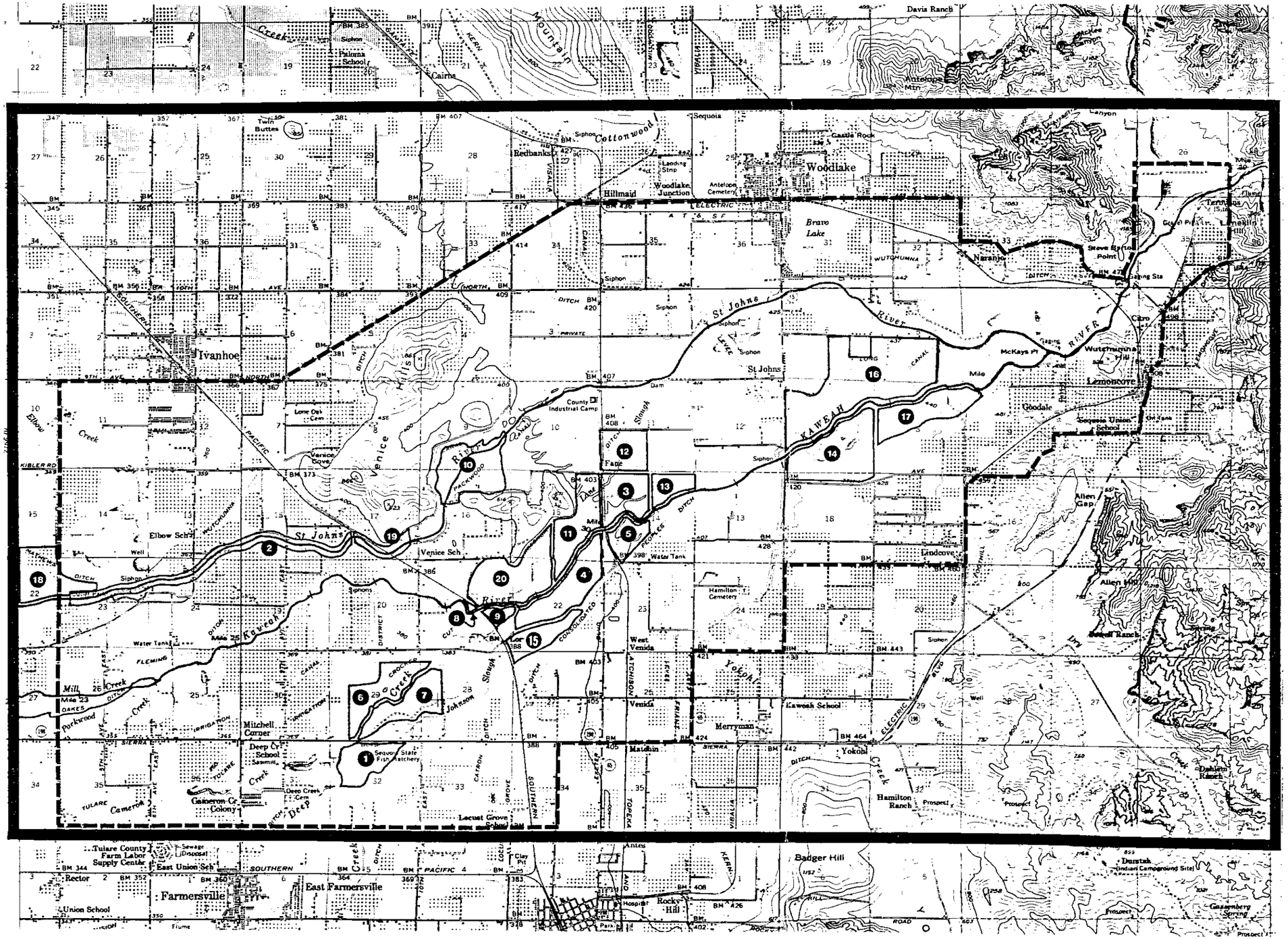
- identification of remaining riparian and valley oak woodland habitat;
- review of the historical extent of riparian habitat within the Corridor;
- identification of physical characteristics required to support riparian habitat (i.e., appropriate soils and hydrology);
- compilation of a complete inventory of plant and wildlife species that occur within the Study Area,
- field surveys to assess the quality of existing riparian habitat; and
- field surveys to identify potential habitat for listed species such as yellow-billed cuckoo, least Bell's vireo and willow flycatcher.

Once this information was compiled a number of potential sites were evaluated using a qualitative matrix of site selection factors. The matrix was used to rank the individual sites from best to worst based upon their overall suitability for riparian habitat enhancement. A detailed discussion of the site selection criteria is provided in Section 2.3.

1.4 Study Area

The Study Area is defined by the alluvial delta of the Kaweah River and its distributaries, including the St. Johns and Lower Kaweah Rivers (see Figure 1-1). The Study Area for Part Two contains approximately 37,000 acres of land, most of which is developed to agricultural uses. A number of rural residences are also found within the study area as well as a portion of the City of Woodlake. A total of 20 potential sites were investigated in the Part Two study, including the 14 sites evaluated by CDM in Part One. Several potential sites in the eastern portion of the Study Area were not evaluated at the request of property owners. The sites investigated by CDM retain their original site numbering from Part One.

The acreage included in the Part Two Study Area is significantly greater than the 23,000 acres studied in Part One. This is because a buffer area of approximately one mile was added to both sides of the Kaweah River Corridor to assure that the wildlife inventories would include all species which utilize the river system.



STUDY AREA

STUDY AREA BOUNDARY

1. CONSOLIDATED DITCH (PERAGIEN)
2. ST. JOHNS RIVER
3. LSID-NORTHEAST
4. LSID-SOUTHWEST
5. LSID-SOUTHEAST
6. KAWEAH OAKS PRESERVE-WEST
7. KAWEAH OAKS PRESERVE-EAST
8. CROCKER ENVIRONMENTAL HABITAT
9. DEEP CREEK ENVIRONMENTAL HABITAT
10. MONROVIA RESERVOIR
11. LSID-NORTHWEST
12. LSID-FARMED
13. YOKOHL CREEK
14. S. K. RANCH
15. LORT DRIVE
16. HANNAH RANCH
17. KAWEAH RIVER
18. CUTLER PARK-NORTH
19. CHARTER OAK
20. JACOB (McCAIN)

KAWEAH RIVER DELTA CORRIDOR ENHANCEMENT STUDY

FIGURE 1-1

NORTH

SCALE = 1 : 69000

KASCO Environmental Consultants

Section 2
Methodology

2.1 Review of Available Information

The objective of this task was to compile all reasonably available information about the natural communities and previously recorded sightings of sensitive species within the Kaweah Delta Corridor. Upon completion of this task, a number of sites were identified for further analysis during the field surveys and evaluation of their potential for habitat enhancement. The review of available information was divided into four subtasks essential for a thorough review of available information.

Literature Search

KASCO obtained and reviewed public documents describing natural resources of the Kaweah River Corridor. A complete list of the references used to prepare this report may be found in Section 6.0 of this report.

Interview Local Information Sources

Locally recognized biologists and persons familiar with the history of the River were contacted by the project team to obtain information regarding any unrecorded sites and habitat ranges of plants and animals found on the Kaweah Corridor. Local resource personnel from governmental agencies such as the California Department of Fish and Game (CDFG), the Department of Water Resources (DWR), and the Bureau of Reclamation (Bureau) were contacted.

California Natural Diversity Database (CNDDB)

The CNDDB is a database maintained by the California Department of Fish & Game to provide information regarding recorded sites and habitats of special-status species. The database was queried for information pertaining to the presence of special status species occurring along the Kaweah River Corridor. Site records for sensitive species occurring within the Exeter, Ivanhoe, Woodlake and Rocky Hill 7.5 minute topographic quadrangles was printed out from the database.

Aerial Photo Reconnaissance

Aerial photographs of the Kaweah River Corridor were examined to identify natural lands and areas of significant riparian habitat. Aerial photos of the Kaweah River Corridor taken on March 30, 1991 were obtained from WAC Corporation in Eugene, Oregon. Aerial photos of the Kaweah River Corridor taken in 1937 were obtained from the Tulare County Library to provide a historical perspective on the extent of riparian woodland habitat within the Study Area.

2.2 Field Surveys

Field surveys were performed to augment the data gathered during the data review and to provide site specific information about each of the potential conjunctive use sites. The field surveys were conducted to provide information about the following:

- presence of nesting and migratory birds in suitable riparian habitat within the study area.
- presence of nocturnal wildlife within the Study Area
- inventories of plant and animal species on potential project sites
- quality of riparian habitat on existing natural lands within the Study Area.

The project team spent five days conducting daytime field surveys within the study area. Nighttime surveys with spotlights were conducted on four nights from dusk to midnight. Observations of species found at each site were recorded on field data sheets, along with information concerning habitat characteristics and quality.

2.3 Site Selection Criteria

Upon completion of the data review and field surveys, the project team evaluated and ranked the potential project sites for their overall suitability for riparian habitat enhancement. A qualitative matrix of site selection criteria was developed in order to compare the suitability of each potential site. No particular weighting or quantitative values were assigned to each selection factor, so there are no quantitative values from which the ranking is derived. The particular characteristics of each site selection factor are discussed below.

Hydrology

Riparian woodland communities, by their nature, occur in hydrologically active areas that are subject to occasional flooding and have shallow sub-surface water available to the root systems of the trees and shrubs. Riparian plant communities such as the Valley Oak Riparian Forest, Valley Oak Woodland and Mixed Riparian Forest were probably found within the 100 year floodplain.

Sites are classified with regard to hydrological characteristics as follows:

Greater than 50 percent of site within 100 year flood zone	Good
Less than 50 percent of site within 100 year flood zone	Fair
Less than 25 percent of site within 100 year flood zone	Poor

Soils

The soils types present on a site have a major effect on its capability to support riparian woodland communities. Riparian woodland is almost exclusively found on coarse-grained soils formed on recent alluvium. Older soil profiles often have cemented hardpans and soils with a high silt and clay content are often not drained well enough to support the root systems of riparian vegetation.

Sites are classified with regard to soil characteristics as follows:

Predominantly alluvial soils	Good

Predominantly terrace or foothill soils	Poor

Historical Habitat Quality

Evaluating historical habitat quality is very difficult; however, it was possible to make some inferences from historical accounts and a review of aerial photographs of the Kaweah River corridor taken in 1937. It is assumed that sites near the existing stream channels and showing evidence of remnant forest in the 1937 photographs probably supported a dense riparian forest prior to conversion to agricultural uses.

Sites are classified with regard to historical habitat quality as follows:

Good evidence of former riparian forest	Good
Some evidence of former riparian forest	Fair
No evidence of former riparian forest	Poor

Existing Habitat Quality

After field surveys of each site were completed an overall rating of the site was made based upon species diversity, presence of native plant species, extent and density of riparian vegetation, and the amount of human-influenced disturbance. The presence of animals which are found primarily in riparian habitats was also used to indicate the health of the riparian community at each site. Another indicator was the amount of reproduction of large tree species taking place at each site.

Sites are classified with regard to existing habitat quality as follows:

Areas of pristine habitat, high species diversity	Excellent
Degraded riparian habitat, low tree reproduction	Good
Remnant riparian habitat, many introduced plants	Fair
Agricultural, industrial, or residential land uses	Poor

Recreation Potential

The ability to use the potential project sites for passive recreational uses (such as fishing, birdwatching, picnicking, hiking and bicycling) was evaluated primarily on site accessibility. None of the potential sites are appropriate for rifle hunting due to their proximity to residential uses and transportation corridors; however, waterfowl and upland game bird hunting with shotguns may be possible at the larger sites.

The recreation potential of the sites are classified as follows:

Directly accessible from a public road	Good
Must cross private land to gain access	Poor

Protection Potential

This factor evaluates the potential to protect existing natural lands from conversion to other uses. Some of the potential project sites are already owned by conservation organizations that intend to preserve and enhance riparian habitat. Existing agricultural lands were not evaluated with regard to this factor.

The protection potential of the existing natural lands sites are classified as follows:

Owners have no stated policy for habitat protection	High
Owners have stated policy for habitat protection	Low

Management Costs

The level of effort required to restore the potential site to pristine riparian forest habitat is considered by this factor. Management costs may include vegetation restoration or planting, eradication of introduced plants and weeds, irrigation and grading to recreate natural site relief.

Sites are classified with regard to management costs as follows:

Major grading, tree planting required (Ag lands)	High
Little grading, some revegetation and pest eradication	Moderate
Passive management to enhance existing habitat	Low

Overall Enhancement Potential

This column was used to summarize the overall suitability of each site for the enhancement of riparian habitat within the Study Area. The alternative sites were grouped into three categories: good, fair, and poor. A good site for riparian enhancement would be one with appropriate soils and hydrology, good historic habitat quality, fair to good existing habitat quality, high protection potential and low to moderate management costs.

The analysis of enhancement potential was based solely on the criteria discussed above. Other factors such as size of the site, contiguity with other protected riparian habitat and the suitability of the site for flood control and groundwater recharge were only considered after the sites had been evaluated using the qualitative matrix. These factors were considered in the final ranking of the sites to differentiate closely ranked sites.

Section 3
Environmental Setting

3.1 Hydrology

The Kaweah River watershed originates at elevations of up to 12,000 feet in Sierra Nevada and drains an area of approximately 505 square miles (DWR 1983). Annual flows of the Kaweah River have averaged 431,790 acre feet for the period 1958-1980. Two other intermittent streams drain into the Study Area: Yokohl Creek and Dry Creek. The Kaweah River produces approximately 95 percent of the water entering the Study Area, while the other two creeks contribute the remaining 5 percent (Bookman and Edmonston 1972).

The Kaweah River divides into two major drainages, the Kaweah and St. Johns Rivers, at McKay Point. The existing St Johns River channel was created by the flood of 1862, creating a drainage on the north side of Visalia and connecting with the Cottonwood and Sand Creek drainages to form the Cross Creek floodway to the west of the Study Area. Below McKays Point the Lower Kaweah River divides into a number smaller creeks, which historically meandered across the alluvial fan, changing coarse as floods carved new channels. Four major creeks have been recognized since the first settler's arrived on the Lower Kaweah River Delta: Mill Creek, Packwood Creek, Deep Creek, and Elbow Creek. Today, these creek beds have been stabilized by control works along the river, however a number of abraded stream channels, cuts and sloughs can still be found on the native land remaining in the Study Area.

As agriculture developed on the Kaweah River Delta, a number of diversion ditches were cut into the existing stream channels to divert water to adjacent farmland. Today, there are 23 diversion points along the Lower Kaweah and St. Johns Rivers below McKays Point (Bookman and Edmonston 1972). In 1928, a headwork was constructed at McKays Point to control flows between the Lower Kaweah and St. Johns Rivers. Completion of Terminus Reservoir in 1959 provided additional control of the flow from the Kaweah River and provided seasonal storage of snowmelt runoff for irrigation. Except in years of extremely high runoff, all of the water produced by the Kaweah River is allocated for agricultural use and is conveyed within the existing river levees and irrigation canal banks.

3.1.1 Flood Events

Flood flows on the Kaweah River are of two types, winter rainfloods and spring snowmelt floods. The rainfloods typically have sharp peak flows, small total volume, and are usually short in duration (3-4 days). These floods occur between November and March and are caused by heavy rains that are often augmented by snowmelt from lower elevations. Snowmelt floods do not produce high peak flows as is the case with rainfloods; but they have a much larger total runoff volume. These floods usually occur between April and July.

The largest rainflood on record on Kaweah River near Terminus Dam was the December 6, 1966 flood, which had a peak inflow of about 105,000 cubic feet per second (cfs) to Lake Kaweah. It produced a three-day volume runoff of 154,000 acre-feet which was largely contained by Lake

HYDROLOGY

FIRM 100 YEAR FLOOD PLAIN

50 GROUNDWATER CONTOURS

WELL NO. 18S/26E-27E1 (REFER TO FIGURE 3-2)

Source: FEMA, 1986 and Bureau of Reclamation, 1992.

KAWEAH RIVER DELTA CORRIDOR ENHANCEMENT STUDY

FIGURE 3-1

NORTH

SCALE = 1 : 69000

KASCO Environmental Consultants

Kaweah (USACE 1971). Extensive flooding from streams below the dam did occur, especially from Dry Creek.

In December 1955, before Terminus Dam was built, the Kaweah River flooded about 126,00 acres of land, from the damsite on the east to Cross Creek on the west, from Cottonwood Creek on the north to Elk Bayou on the south (USACE 1971). Most of the flooded area was along the river and its principal distributaries: St. Johns River, Mill Creek, Cameron Creek, Packwood Creek, Cross Creek, and Elk Bayou. Parts of Visalia, Farmersville, Three Rivers, and Woodlake were inundated, as well as large agricultural areas. Flood waters from the Kaweah and Tule Rivers and other streams also entered the Tulare Lakebed and caused extensive damage.

It is estimated that a flood with a peak flow greater than 22,000 cfs above the division works at McKays point would overtop or breach the existing south levee of St. Johns River and flood Visalia, causing damage in the urban areas (USACE 1971). Statistical analysis of storm events indicates that this may occur once every 60 years on average. A continuous flow at McKays Point in excess of 15,000 cfs would also probably cause damage in Visalia.

The largest snowmelt flood of record on the Kaweah River near the Terminus Dam site occurred in the spring of 1906. The flood produced a maximum mean daily discharge of 7,260 cfs and a total runoff volume of 814,000 acre-feet from April through July. The snowmelt flood of 1969 approached that of 1906 in total April-July volume (799,000 acre-feet) and in maximum daily flow (6,800 cfs) (USACE 1971). Storage in Lake Kaweah greatly reduced the effects of the flood, and the reduced outflow rates of a maximum of 5,600 cfs were generally contained in the existing channels of the Lower Kaweah and St. Johns Rivers. Of the total April-July inflows to Lake Kaweah, plus downstream accretions, about 172,000 acre-feet reached Tulare Lakebed and about 640,000 acre-feet were diverted and utilized within the Kaweah Delta service area.

With regulation provided by Lake Kaweah, only in years of exceptionally high snow accumulation will snowmelt runoff cause damage downstream along the Kaweah River and its distributaries. Serious flooding in the Tulare Lakebed may occur whenever the total annual runoff is in excess of 120 percent of normal, or in excess of about 500,000 acre-feet.

The Federal Emergency Management Agency (FEMA) produces Flood Insurance Rate Maps that delineate areas subject to inundation during an 100 year flood event (a flood which occurs once every 100 years on average). The location of the 100 year flood zone within the Study Area is shown in Figure 3.1.

3.1.2 Groundwater

Good quality groundwater is found throughout the Kaweah River alluvial fan. Within the Study Area the aquifer consists of young alluvial deposits (to a depth of up to 50 feet) overlying older alluvium and continental deposits. The younger alluvium consists of gravelly sands, silty sands, silts and clays deposited along stream channels and then laterally in a westward direction. The soils formed on the younger alluvium generally have deep profiles that are free from clay or hardpan soils and, therefore, have moderate to high percolation rates that make them ideal for groundwater recharge. (Bookman and Edmonston 1972).

The older alluvium found beneath the young alluvial deposits forms the principal water bearing deposit within the Study Area. The older alluvial material is generally highly permeable and produces good groundwater yields (Bookman and Edmonston 1972). The aquifer in these deposits is generally unconfined, meaning that there are few subsurface features such as clay layers which impede the movement of groundwater. In some cases, however, intermittent clay lenses may create a semi-confined aquifer which causes localized differences in subsurface flow and groundwater yield.

Continental deposits consist of predominantly finer grained material such fine sands silts and clay and, therefore tend to have low to moderate permeability. Within the Study Area, these deposits tend to underlie the older alluvium at a depth of 200 to 300 feet (Bookman and Edmonston 1972). These deposits do not constitute a significant source of groundwater within the Study Area.

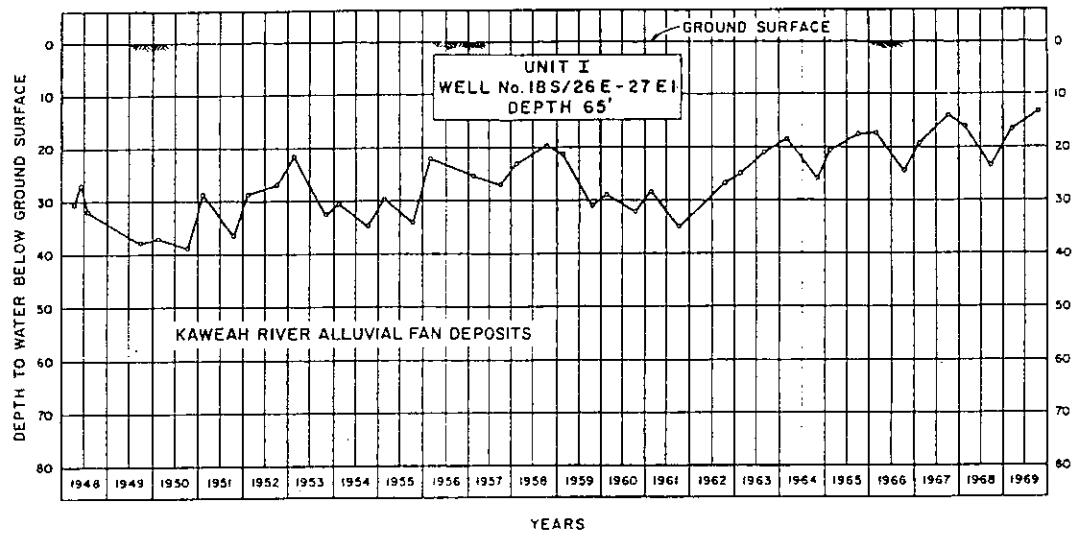
Groundwater within the Kaweah River Delta is replenished from a variety of sources: percolation in the Kaweah River system, percolation in canals conveying Kaweah River and CVP water, percolation in off-stream spreading basins, deep penetration of unconsumed irrigation water, and deep penetration of unconsumed precipitation. The major source of groundwater replenishment is direct percolation from the channels of the Kaweah River system, which is estimated to average 200,000 acre feet per year (Bookman and Edmonston 1972). This water moves rapidly through the permeable young alluvium found along the river channels into saturated zones in the older alluvium.

The water table in the vicinity of the younger Kaweah River alluvial fan deposits is relatively stable as evidenced by the hydrograph of a well located near the Consolidated Peoples Ditch (see Figure 3-1). The water table drops somewhat in dry years and seasonally with heavy pumping in the late summer and fall; however, it recovers quickly when flows are restored in the river channels and irrigation ditches.

Lines of equal depth to groundwater for the spring of 1992 are illustrated in Figure 3-2. Depth to groundwater varies from less than 20 feet in the eastern end of the Study Area to greater than 70 feet in the northwest corner (Bureau of Reclamation 1992). These groundwater levels reflect the effect of six years of drought in which groundwater pumping has exceeded annual recharge from the Kaweah and St. Johns Rivers. The depth to groundwater in the spring of 1984 (following a series of "wet" years) was not greater than 40 feet anywhere within the Study Area and in some locations was less than 10 feet deep (Bureau of Reclamation 1984).

FIGURE 3-2

Hydrograph of Well No.18S/ 26E-27E1 1948-1969



3.2 Soils

Three major classes of surface soils developed from different types of parent material are present within the Study Area: foothill soils, terrace soils, and recent alluvial soils. Alluvial soils are found predominantly along the existing stream channels of the Kaweah/St.Johns alluvial fan (see Figure 3-3). Terrace soils are found at slightly higher elevations on the north and south side of the alluvial fan on the valley floor. Foothill soils are found on the slopes of the foothills that constrict the width of the alluvial fan in the eastern portion of the Study Area and in the Venice Hills further to the west.

Soils formed in recent alluvium are typically deep, well drained soils formed with coarse-grained material (sand and gravel) deposited by relatively recent hydrologic activity. These soils are too young to develop profiles with cemented hardpans or other features which prevent the movement of water. These soils are also typically free of alkaline conditions. Soil of the Tujunga, Greenfield, Hanford, Honcut, Yettem, San Emigdio and Foster series make up the alluvial soils found within the Study Area (Stephens 1977; Sorie et.al. 1940).

SOILS

ALLUVIAL SOILS

TERRACE SOILS

FOOTHILL SOILS

Source: Stephens, 1997 and Storie et al., 1940.

KAWEAH RIVER DELTA CORRIDOR ENHANCEMENT STUDY

FIGURE 3-3

NORTH

SCALE = 1 : 69000

KASCO Environmental Consultants

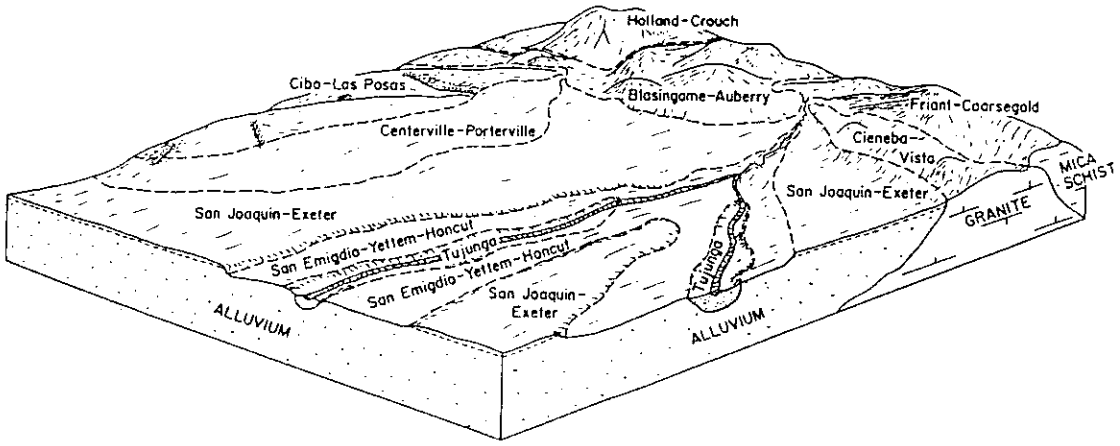
Terrace soils are typically formed on older alluvium and are often characterized by the presence of a cemented hardpan at a depth of 1.5 to 3.5 feet. Mima mounds or hogwallows are associated with terrace soils and historically covered extensive areas of the eastern San Joaquin Valley between the river channels. Soils of the San Joaquin, Madera, and Exeter series are considered to be terrace soils (Stephens, 1977).

Foothill soils generally develop in place through weathering of the underlying bedrock by physical and biological processes. These soils may vary from deep to shallow and are generally formed on slopes which may vary from gently undulating to steep and are typically well to excessively drained. Soils of the Auberry, Blasingame, Cibo, and Coarsegold series make up the foothill soils within the Study Area (Stephens, 1977).

Historically, riparian woodland was probably only found on recent alluvial soils. Aerial photographs of the Lower Kaweah/St. Johns Corridor from 1937 show an abrupt transition from riparian woodland to grassland habitat that corresponds very closely to the transition between alluvial and terrace soils. Foothill soils within the Study Area do not appear to support woodland communities as evidence by the absence of native trees on upland slopes.

FIGURE 3-4

Physiographic Relationship of Soils in the Study Area



3.3 Biotic Resources

3.3.1 Natural Communities

There are three major categories of natural habitat found in the Study Area: riparian forest, oak woodland and grassland. These may be further subdivided into natural communities, which are associations of plant species that grow in assemblages under similar ecological conditions. Generally, they are named for the dominant species found in the association. Definition of plant communities is important not only because it identifies types of plants that are present, but also because it indicates habitat types and animal species which may be found in the community.

A total of nine natural plant communities were identified within the Study Area, and are based on Holland's Preliminary Descriptions of the Terrestrial Natural Communities of California (1986). Most of the regional biological surveys conducted in the southern San Joaquin Valley follow the plant community classification system developed by Holland. Several of these communities were only limited to several acres and, therefore, were not mapped. Detailed descriptions of the natural communities found within the Study Area are provided in Appendix H.

Riparian Forest

In the arid Central Valley, water-rich riparian communities provide ideal conditions for a flora rich in species. By growing in layers, riparian plants provide cooling and reduced moisture-loss for all other vegetation growing in their shade. The diversity of plants creates a range of temperature and humidity which affords cover and food for a myriad of plant-eating animals including insects and small mammals. This abundant plant and animal food sustains a tremendous variety of birds as well. Riparian habitat supports a higher species diversity of birds and greater bird populations than any other habitat in California.

Riparian forests are dynamic systems that experience major disturbances every time flooding occurs. Tremendous volumes of high velocity snowmelt are capable of scouring vegetation off islands, sandbars, and stream levees. This is part of a natural process that creates forest openings where grasses, shrubs, and young riparian trees (willows, cottonwoods, sycamore, valley oak, alder, ash, and buttonbush) become established on areas where their seeds fall on bare moist soil. Such annual flood events helped maintain a diverse array of species with a vigorous range of age classes; a healthy, reproducing forest.

Before becoming mature forest, riparian vegetation passes through several seral (successional) stages. Two of the riparian communities found in the Study Area are characteristic of the early seral stages where shrubs and small trees form a shady layer of foliage above the herbaceous ground cover plants. Elderberry Savannah (Holland E.C. 63430) consists of stands of riparian shrubs dominated by southwestern or desert elderberry (*Sambucus mexicana*). A small area covered by this community was found in the eastern part of the Study Area. Remnants of Great Valley willow scrub (Holland E.C.63410) were found along the river and stream channels on most of the study sites. This community consists of a variety of willow species, as well as Fremont's cottonwood, California rose, and California wild grape.

Mature riparian forest, often described as a gallery forest, consists of vegetation in different layers; tree canopy, shrub understory, and herbaceous ground cover. Lianas (climbing vines) create links with vegetation in every strata. When this kind of forest reaches a mature stage, the canopy may be dominated by valley oak, sycamore, or cottonwood. The shrub understory consists of elderberry and blackberry with mule fat, buttonbush, Oregon ash, and shrubby willows growing nearest the streams. The herbaceous understory consists of wildrye, mugwort, ragweed, goldenrod, sedge, and nettle. Lianas include wild grape and virgin's bower.

Two types of riparian forest were found along the Kaweah River Corridor: Great Valley valley oak riparian forest (Holland E.C. 61430) and Great Valley mixed riparian forest (Holland E.C.61420). The major difference between these communities is that the canopy of valley oak riparian forest is dominated by valley oak (*Quercus lobata*); whereas, the canopy of mixed riparian forest is dominated by western sycamore (*Platanus racemosa*) and Fremont's cottonwood (*Populus fremontii*).

A clear demarcation between these two communities was observed near the west end of the McKays Point site. Mixed riparian forest was found upstream from this site all the way to Terminus Dam. Very few valley oaks were observed at all along this stretch of the River, and the ones that were observed appeared to be less than 25-30 years old. Prior to the construction of Terminus Dam this area may have been flooded too frequently and the soils may have been too gravelly to support valley oak riparian forest.

Valley Oak Woodland

Moving away from the streamside environment, conditions become drier and the valley oak riparian forest gives way to valley oak woodland. Valley oak is usually the only tree found in this community forming an open canopy that rarely exceed 30-40 perçent total cover. The dense herbaceous understory found in valley oak riparian forests is replaced by annual grasses such as ripgut brome, wild oats and foxtail barley. Native creeping wild rye (*Elymus triticoides*) is also commonly found in this community.

It was difficult to discern valley oak woodland from remnant valley oak riparian forest during the field surveys. Various agricultural uses have over time impacted the dense understory from riparian forest, replacing the herbaceous shrubs with annual grasses. Much of what presently appears to be valley oak woodland could revert to riparian forest if disturbance was removed; especially near the stream channels.

Grassland

With the arrival of settlers, natural valley grasslands underwent such rapid change that their former condition will always be open to debate (Wester 1981). Most experts agree that dry interior valleys like the Tulare Basin, had only scattered perennial grasses including bunchgrasses. Today, grassland communities in the San Joaquin Valley and adjacent foothills are dominated by introduced, annual Mediterranean grasses and native herbs. On most sites the native species, such as needle grass (*Stipa sp.*) and perennial bunchgrasses, have been largely or entirely supplanted by introductions. Those few remnant grassland habitats which are still rich in native grasses (including perennial bunchgrasses) and showy native herbs (wildflowers) are

usually found on unusual substrates, such as serpentine or somewhat alkaline soils (Smith and Berg 1988).

The conversion of native grassland is largely due to both intentional and accidental introduction of non-native grasses and forbs (like filaree and bur-clover). Most of these plants are annual species of Mediterranean origin. Once established in California, these aggressive non-native plants proliferated as herds of nomadic grazers and browsers (the native tule elk, pronghorn, and deer) gave way to the increased grazing pressure of domestic livestock that feed, often year-round, in fenced pastures.

Small areas of native grassland communities were found scattered amongst the Non-native grassland (Holland E.C. 42200) which dominates most of the grassland habitat found within the Study Area. Remnants of Valley sacaton grassland (Holland E.C.42120) were found on the Lort Drive site and on the LSID-Northwest site. This community is dominated by alkali sacaton bunchgrass (*Sporobolus airoides*). Alkali meadow (Holland E.C. 45310) and Valley wildrye grassland (Holland E.C. 42140) are found on the Kaweah Oaks Preserve.

The northern hardpan vernal pool community (Holland E.C. 44110) is found in non-native grassland that occurs in terrace soils containing mima mounds or hogwallows. This community was historically very common on the terrace soils found within the Study Area.

3.3.2 Plants

A total of 180 plant species representing 57 vascular plant families were found in the Study Area during the field surveys or are known to occur within the Study Area (Appendix I). Approximately 55 of these species (33 percent) are found almost exclusively in riparian and wetland habitats. Many of these species can be used as "indicator" species, that is their presence indicates a good riparian habitat quality.

Plant species considered good riparian habitat indicators include Indian hemp (*Apocynum cannabinum*), western ragweed (*Ambrosia psilostachya*), California mugwort (*Artemisia douglasiana*), mule fat (*Baccharis viminea*), Western goldenrod (*Solidago occidentalis*), white alder (*Alnus rhombifolia*), southwestern elderberry (*Sambucus mexicana*), valley oak (*Quercus lobata*), whitestem hedge nettle (*Stachys albens*), wild licorice (*Glycyrrhixa lepidota* var. *glutinosa*), leather root (*Psoralea macrostachya*), oregon ash (*Fraxinus latifolia*), panicled willow herb (*Epilobium paniculatum*), western sycamore (*Platanus racemosa*), pale smartweed (*Polygonum lapathifolium*), western virgin's bower (*Clematis ligusticifolia*), California blackberry (*Rubus ursinus*), narrow-leaved milkweed (*Asclepias fascicularis*) (a host plant to monarch butterflies), California rose (*Rosa californica*), buttonbush (*Cephalanthus occidentalis*), valley willow (*Salix gooddingii*), sandbar willow (*S. hindsiana*), red willow (*S. laevigata*), arroyo willow (*S. lasiolepis*), Fremont cottonwood (*Populus fremontii*), Indian tobacco (*Nicotiana bigelovii*), stinging nettle (*Utica holosericea*), and California wild grape (*Vitis californica*). It is noteworthy to mention that most of these plant species were found on a small site within the Study Area, an area of approximately 8 acres.

Four plant species found within the Study Area are noteworthy in that they are an important food source much of the wildlife of the area. The plant species are southwestern elderberry, Himalaya berry, California blackberry (*Rubus procerus*), and California wild grape. These plants

along with western virgin's bower also provide valuable understory cover for wildlife, and form lianas (hanging vines) from the branches of canopy trees. These lianas create a continuous link between the herbaceous understory and the forest canopy.

Away from the immediate river's edge, three native grasses are worthy of note. They are creeping wildrye (*Elymus triticoides*), saltgrass (*Distichlis spicata*), and alkali sacaton bunchgrass (*Sporobolus airoides*). They are often present within the grassland component of valley oak woodland. Unfortunately, competition with annual non-native grasses such as foxtail barley, ripgut brome, and wild oat, has kept the native perennial grasses restricted in most areas.

79 of the 180 species (44%) are introduced (non-native) species. Many of the introduced species are considered to be weeds and are often difficult to control. Three introduced plants which are particularly troublesome in riparian communities are castor bean (*Ricinus communis*), tamarisk (*Tamarix* sp.) and giant reed (*Arundo donax*) which is known locally as bamboo. These plants can quickly overtake native riparian vegetation, choking out all but the hardiest and most well established native plants.

A few of the plant species found within the Study Area are worthy of special note. They are discussed briefly below.

White Alder (*Alnus rhombilfolia*) - White alders were once a more common tree species in the riparian communities within the Study Area. All of the white alders found during the 1993 field surveys were senescent trees and no new saplings were present. Some sites supported only standing dead alders, other trees were present in areas along the Lower Kaweah where little understory remained (LSID-Southwest). This tree species could benefit greatly from revegetation efforts.

Valley oak (*Quercus lobata*)- This immense oak species is a component of two plant communities within the Study Area, valley oak riparian forest and valley oak woodland (each is discussed in Section 3.3.1). Valley oaks play host to an abundance of insect, mammal, and bird species such as cynipid wasps (the gall makers), oak moths, raccoons, ground squirrels, bushtits, western wood pewees, and yellow-rumped warblers. Although many of the sites surveyed supported some number of valley oaks, few sites exhibited much reproduction of oaks (small trees), usually as a result of grazing pressures or clearing.

Sandbar Willow (*Salix hindsiana*) - This willow was conspicuously absent from most of the potential project sites, when it should normally be found in dense thickets along the river channels. Cattle preferentially graze this species when it is present and have probably caused its demise.

3.3.3 Animals

Birds

69 bird species were observed in the Study Area during the Spring 1993 field surveys, and another 94 bird species have been recorded (within the last 5 years) within the Lower Kaweah Corridor (see Appendix J). The total number of bird species known to occur within the Study Area is 163. Of the total number of bird species found within the Study Area, 63 probably breed

in the area; a good indication of the richness of the Valley Oak Riparian Forest with its layered vegetation and abundant wild food.

Many birds, such as western bluebird, American robin, northern mockingbird, phainopepla, and house finch, utilize the native fruit-bearing shrubs and vines which are found in abundance within the riparian communities. Wherever elderberry, wild grape, Himalaya, and California blackberry grow, fruit-eating birds appear as the fruit ripens.

California towhee, rufous-sided towhee, black-headed grosbeak, blue grosbeak, and lazuli bunting are among the seed-eating species that inhabit the riparian thickets along the Lower Kaweah and St. Johns Rivers. California towhee and rufous-sided towhees are present all year within the Study Area, but are found locally only where there is an extensive, dense brushy understory. Black-headed grosbeak, blue grosbeak, and lazuli bunting are all summer visitors, and are all presumed nesting within the Study Area. Like the towhees, the blue grosbeak and lazuli bunting both require areas with sufficient understory, the blue grosbeak often preferring stinging nettle for a perch and nest site. Black-headed grosbeaks can inhabit more open woodlands. All five of these bird species will also eat small invertebrates, such as insects and snails, and occasionally fruit.

Riparian habitats, as well as all wetland habitats, are prolific insect producers. Northern oriole, common yellowthroat, yellow warbler, black phoebe, ash-throated flycatcher, and western wood pewee are a few of the birds found within the Study Area that feed almost exclusively on insects. Northern oriole, yellow warbler, ash-throated flycatcher, and western wood pewee are summer visitors, while common yellowthroat and black phoebe can be found within the Study Area yearround. Black phoebes are often observed sallying from a stream or pond-side perch on short flights to capture flying insects. All these insect-eating bird species are known to nest within the Study Area.

A few bird species found within the Study Area are worthy of special note, and are discussed below. Most depend on riparian or oak woodland habitat conditions and the food sources available within these habitats.

Wood duck - 23 wood ducks flew from a willow-lined pond on the LSID-Northwest site on 4 June 1993. The wood duck is an indicator species of a healthy valley oak riparian forest. When they occur in an area and are breeding in good numbers, it usually means that there is abundant water, mature trees with nest cavities, and ample food (acorns, other seeds, and aquatic invertebrates).

Red-shouldered Hawk - The range of this hawk, more than any other raptor species in the Valley, is restricted almost exclusively to riparian corridors like the Lower Kaweah and St. Johns Rivers. It is not a hawk of open country like a red-tailed hawk. The fact that they still frequent the Study Area is an indication that portions of local streams still support good wildlife habitat. Red-shouldered Hawks were heard and seen on several field days during the 1993 field survey.

California Quail - This gamebird has disappeared from most of its original haunts in the Central Valley. Populations are able to survive today only in areas where there is sufficient understory

to provide them with needed food and cover. During the 1993 field survey, quail were observed various sites in the Study Area.

Woodpeckers - Acorn woodpecker, Nuttall's woodpecker, downy woodpecker, and Northern flicker (all breeding species) are present in forested areas within the Study Area. These important chiselers excavate cavities of various sizes; from the tiny opening created by downy woodpecker (the rarest of the four species) to the largest chambers fashioned by Northern flickers. After a single season's use by the woodpecker, these vital nest cavities are available for use by at least seven of the other birds that they share the forest with. Dead limbs and snags (dead trees) which are allowed to remain in this habitat encourage the activities of these bird-home developers.

Mammals

Riverlands within the Study Area consist of three major components: the river itself, the riparian woodlands, and the surrounding grasslands. Many mammal species utilize two or all three communities, while some will confine their activities to just one. Some of the mammal species that are found within the Study Area are described briefly below.

Mammals known to utilize the rivers and stream channels include beaver and river otter. Today, beavers are controlled to the point of occasional occurrence, and none were observed within the Study Area during the spring surveys.

Other mammals never stray far from the river edge or riparian woodland, but also travel back and forth from river to grassland (or farmland). These animals include mule deer, coyote, gray fox, desert cottontails, jackrabbits, and striped skunks. These animals move out into surrounding grasslands and farmlands to forage during the night, and seek out the riparian thickets and woodlands for cover, shade, travel corridors, and protection during the day. Mule deer (as well as striped skunk, raccoon, and jackrabbit) were observed within the Study Area during the spotlight surveys.

Ringtail, mink, and black bear have all been recorded at the Kaweah Oaks Preserve, and are presumed occasional at other locations within the Study Area. Broad-footed mole, western harvest mouse, California vole, and long-tailed weasel were also observed within the Study Area. A complete list of mammals (both observed and recorded) within the Study Area is included in Appendix K.

Reptiles and Amphibians

Common amphibians found within the Study Area include western toad, Pacific treefrog, bullfrog, and western pond turtle. Western pond turtle occurred along riverbanks only where fallen trees or debris was available for basking on, or on ponds within the Study Area.

Common reptiles observed within the Study Area include western fence lizard, western whiptail, gopher snake, and common garter snake. Western black-headed snake, western rattlesnake, California legless lizard, Gilbert's skink, and southern alligator lizard are also known to occur within the Study Area. A complete list of reptiles and amphibians that are known to occur within the Kaweah River Corridor is included in Appendix L.

3.3.4 Fisheries

The historic intermittent nature of in-stream flows of the Kaweah River have had a profound effect on the fishery. It is unlikely that a stable, permanent fishery ever existed on the river since flows were based on seasonal runoff from the Sierras and were interrupted for 4-8 months every year.

Nevertheless, as a result of construction of various water management structures there are several "swamping nodes" along the St. Johns River where standing water remains even during periods when water is not being released from Terminus Reservoir. The composition of the fishery on the lower reaches of Kaweah River is largely dependent on two sources: Kaweah Lake and the Friant-Kern Canal. The species present in the Lower Kaweah and St. Johns Rivers are introduced by releases from these two water sources. Releases from Terminus Dam are introduced into the lower reaches of the Kaweah River at the Terminus Forebay. Water is diverted from the Friant Kern Canal into the St. Johns River near Redbanks.

In the fall of 1987, Kaweah Lake and the lower reaches of the Kaweah River were treated with Rotenone, a chemical that is toxic to all species of fish. The treatment was performed to eradicate white bass from the Kaweah River system and to complete its removal from lakes and streams in the Central Valley of California. The treatment also killed any other fish present in the river at the time the Rotenone was applied, providing an excellent opportunity to evaluate the status of the fishery.

Students from California State University Fresno sampled fish carcasses from the Lower Kaweah River on October 19 and 20, 1987. A total of 15 species of fish were collected during the sampling (see Appendix M). 85 percent of the biomass collected over the sampling period was contributed by five species of fish : common carp (*Cyprinus carpio*) (53 percent), Sacramento sucker (*Catastomus occidentalis*) (19 percent), white catfish (*Ictalurus catus*) (5 percent), redear sunfish (*Lepomis microlophus*) (4 percent) and spotted bass (*Micropterus punctatus*) (4 percent) (CSUF 1989). No white bass were recovered from the lower Kaweah River during the sampling period.

Kern brook lamprey (*Lampetra hubbsi*) was also collected from the Lower Kaweah River by the CSUF survey team. This native fish is a Category 2 candidate for federal listing as threatened or endangered; however, very little is known about it's distribution or status. The CSUF team collected 55 adult lamprey during the sampling period (CSUF 1989).

Electroshock sampling by the California Department of Fish and Game in November, 1992 produced seven species: bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), brown bullhead (*Ictalurus neblosus*), black crappie (*Pomoxis nigromaculatus*), largemouth bass (*Micropterus salmoides*), spotted bass, and mosquitofish (*Gambusia affinis*) (Tim Heyne pers. comm.). Samples were taken at three locations between McKays Point and the Terminus Forebay. No recent electroshock samples have been taken below McKays Point. Kern brook lamprey was not found during the CDFG sampling.

The species composition of the fishery below Terminus Dam is typical of most warm-water fisheries in California. Water temperatures are too high and in-stream flows too intermittent to

support a cold water fishery, which is characterized by the presence of salmonid fishes (trout and salmon). Most of the species present are introduced game fish (bass or sunfish), escaped bait fish (threadfin shad and golden shiner), or fish used for pest control (mosquitofish).

The only native fish that have been recently collected on the Kaweah River below Terminus Dam are Kern brook lamprey, Sacramento squawfish (*Ptychocheilus grandis*), and Sacramento sucker. It is also likely that two other native species occur on the Kaweah River blow Terminus Dam: California roach (*Hesperoleucus symmeticus*) and hardhead (*Mylopharodon conocephalis*).

3.3.5 Rare, Threatened & Endangered Species

The extensive loss of riparian habitat throughout California has caused significant declines in the populations of a number of plant and animal species that rely on this community for critical portions of their life cycles. A list of special status plant and animal species found in riparian habitats is presented in Table 3-1 and discussions of important species are presented below. Also discussed is a group of 11 special status raptors and the Endangered San Joaquin kit fox. Restoration of large areas of contiguous riparian habitat may assist in bringing these species back to a higher population level.

Table 3-1
Sensitive Species Found in Riparian Habitats

Common Name	Scientific Name	Status	
		Federal	State
Vertebrates			
Riparian Brush Rabbit	*Sylvilagus bachmani riparius*	C1	CSC
San Joaquin Valley Woodrat	*Neotoma fuscipes riparia*	C2	CSC
Southern River Otter	*Lutra canadensis sonorae*	C2	CSC
Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	-	CE
Willow Flycatcher	*Empidonax trailii*	-	CE
Yellow-breasted Chat	*Icteria virens*	-	CSC
Yellow Warbler	*Dendroica petechia brewsteri*	-	CSC
Least Bell's Vireo	*Vireo bellii pusillus*	E	CE
Tri-colored Blackbird	*Agelaius tricolor*	C2	CSC
Black Swift	*Cypseloides niger*	-	CSC
Great Blue Heron	*Ardea herodias*	_	CSC
Southwestern Pond Turtle	*Clemmys marmorata pallida*	C1	CSC
Kern Brook Lamprey	*Lampetra hubbsii*	C2	CSC
Hardhead	*Mylopharodon conocephalus*	-	CSC
Invertebrates			
Elderberry Longhorn Beetle	*Desmocercus californicus dimorphus*	T	-
Plants			
Valley Sagittaria	*Sagittaria sanfordi*	C2	-

Table 3-2
Endangerment Designations

1.Federal. Federal categories per the Endangered Species Act, Administered by the USFWS.

E	Federally-listed Endangered. In danger of extinction throughout all or a significant portion of its range.
T	Federally-listed Threatened. Likely to become an endangered species within the foreseeable future.
PE	Proposed Endangered. Regulations have been proposed as to the management of the species, but have not been finalized.
PT	Proposed Threatened. Regulations have been proposed as to the management of the species, but have not yet been finalized.
C_1	Candidate 1. Sufficient data on file to support consideration for proposal to list as endangered or threatened.
C_1*	Sufficient data on file but presumed extinct.
C_2	Candidate 2. The threat and/or distribution data insufficient to support listing at this time.
C_2*	Insufficient data on file but presumed extinct.
C_3	Non-candidate.
C_3A	Extinct.
C_3B	Taxonomically invalid as a distinct species.
C_3C	Too widespread or not threatened at this time.

2.State. Under the 1984 California Endangered Species Act, species of concern are listed as:

CE	Endangered. Prospects for survival and reproduction are in immediate jeopardy from one or more causes.
CT	Threatened. Not presently threatened with extinction but likely to be endangered in the foreseeable future in the absence of special protection and management efforts.
CR	Rare. Not presently threatened with extinction, but in such small numbers throughout its range that it may become endangered if its present environment worsens.
CC	Candidate. Species is currently under review for listing. This category is roughly equivalent to a "proposed" federal listing.
CSC	Species of Special Concern. Listing of mammal and bird species that are under consideration for candidate status.

Riparian Brush Rabbit (*Sylvilagus bachmani riparius*) is a Category 1 candidate for federal listing and is a California Species of Special Concern. This species prefers dense thickets of wild rose, willow, and blackberry. The only presently known population is found on the lower Stanislaus River at Caswell State Park. It is unlikely that riparian brush rabbit is present in the Kaweah River Corridor, because there is too little dense riparian understory to support a viable population of this species.

Riparian Woodrat (*Neotoma fuscipes riparia*) is a Category 2 candidate for federal listing and a California Species of Special Concern. This species is known to inhabit riparian areas on the San Joaquin, Stanislaus and Tuolumne Rivers; its presence on the Kaweah River is unconfirmed at this time. Preferred habitat consists of mixed shrubs and woodland, where suitable nesting sites in trees snags and logs are present. Suitable habitat for this species was found at the LSID-Southwest and Kaweah Oaks-East sites. Trapping studies should be performed to determine if this species is present within the Kaweah River Corridor.

Southwestern River Otter (*Lutra canadensis sonorae*) is Category 2 Candidate for federal listing and a California species of special concern. This species spends almost its entire life cycle in aquatic and riparian habitat, feeding on fish and other aquatic organisms and denning in stream banks. They are probably infrequent visators to the eastern edge of the Study Area.

Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is listed as Threatened in California and is a Category 2 Candidate for Federal listing. None were found during this study. Once an uncommon breeding species in Central Valley riparian habitat, they have not been reported in this area in decades, except as very rare migrants. The riparian habitat in the Study Area does not currently support the extensive forest of mature willows and cottonwoods required to maintain a breeding population of cuckoos.

Yellow-breasted chat (*Icteria virens*) is a Species of Special Concern which may still breed in the area but was not seen or heard during the 1993 field survey. This species is a rare but regular migrant in this part of the Central Valley but breeding habitat of this rare summer visitor (April to August) is limited to riparian forests with low, dense ground cover vegetation. This species was formerly a more widespread breeder but has suffered from habitat loss and cattle grazing. The only recent local breeding record for yellow-breasted chat is from the Terminus Dam Afterbay site in the late 1980's.

California yellow warbler (*Dendroica petechia brewsteri*) is a Species of Special Concern that was seen during the 1993 field survey. Ray (1906) reported finding at least 6 active yellow warbler nests during a single week in May; something unheard of in Central Valley riparian habitat since the increase this century of brown-headed cowbird (*Molothrus ater*) parasitism. Although yellow warblers occur here now primarily as spring and fall transients, a single yellow warbler was seen on 11 June 1993 in a stand of dense riparian forest at Kaweah Oaks Preserve-East. The relatively late date of this sighting suggests that this may have been a breeding bird.

Willow flycatcher (*Empidonax traillii*) is listed as Endangered by the State of California; but does not have a Federal designation. Single willow flycatchers were seen on 16 May 1993 at Kaweah Oaks Preserve-East and on 11 June 1993 at LSID-Southeast. Both of the willow flycatcher records probably represent spring transients because this bird is a late spring migrant and neither individual was vocalizing. The kind of extensive, dense willow scrub habitat suitable for willow flycatcher breeding is lacking in most of the Study Area today. Loss of riparian habitat and

cowbird parasitism have both contributed to the near total disappearance of willow flycatcher as a breeding species in Central California.

Least Bell's vireo (*Vireo bellii pusillus*), listed as State and Federally Endangered, was once the most abundant breeding songbird in Central Valley riparian habitat. Least Bell's vireo has not been reported as a breeding species in this area since the 1950's because of cowbird parasitism and habitat loss. A single male Least Bell's vireo was observed in August 1989 as it sang and foraged in Valley oak riparian forest and willow scrub at Cutler Park (along the W edge of the Lower Kaweah Corridor Study Area). This individual was probably a post-breeding male that had already nested somewhere else in California that year.

Tri-colored blackbird (*Agelaius tricolor*) is a Category 2 Candidate for Federal listing that is often found in riparian and freshwater marsh habitats. Its status as a breeding species in the Study Area is unknown and may fluctuate from year to year. For breeding, tri-colored blackbirds usually require dense tule marshes or patches of tules, cattails, or other emergent vegetation; breeding marshes may be wet or dry. Tri-colored blackbirds probably nest periodically in the Study Area but none were found breeding in the Study Area during the 1993 field survey. This colonial-nesting blackbird is a wide-ranging species that makes lengthy daily flights between nighttime roosts and daytime feeding areas. Such foraging flocks were seen in flight over LSID-Northeast, LSID-Southwest, and Kaweah Oaks Preserve-East during the 1993 field survey.

Black swift (*Cypseloides niger*), is a Species of Special Concern that nests in the high Sierra in rock crevices behind waterfalls. They range widely during the day in search of aerial insects. Their summer feeding forays sometimes cover hundreds of miles and take them out over the floor of the Central Valley. Valley riparian areas, like those in the Study Area, are evidently important navigation corridors for black swifts as they make their way to and from their high-country breeding sites. At least seven individuals were seen between 1904 and 1943 hours on 7 June 1993 as they made their way up the St. Johns and Lower Kaweah Rivers past McKays Point at a height of approximately 100 to over 500' above the ground.

Great blue heron (*Ardea herodias*) and great egret (*Casmerodius albus*) are both included on the California Natural Diversity Database's (CNDDB) Watch list. Foraging occurs in a variety of habitats including aquatic margins, canals, ditches, pastures, and even dry upland areas. Non-breeding birds are found throughout the county in all seasons with populations being greatest in the winter months. Breeding takes place from March to mid-summer. These colonial-nesting waders nested in 1993 in an open grove of Western sycamores that grow along both banks of the Lower Kaweah River where it crosses LSID property about 1/2 mile E of Rd. 196. Such breeding sites are worthy of consideration as they are sensitive to disturbance during this activity.

Southwestern pond turtle (*Clemmys marmorata pallida*) is a Category 1 Candidate for Federal listing and a California Species of Special Concern. These turtles frequent streams, rivers, ponds, lakes, and marshes. Dense cover and exposed basking sites are key components to the occurrence of western pond turtles in local wetland habitat types. Western pond turtles are

omnivorous; in addition to aquatic vegetation, turtles feed on a variety of aquatic invertebrates (Bury 1986; Holland 1985a, 1985b). Pond turtles grow slowly and may live as long as 40 years. Mature females lay one to thirteen eggs per clutch in upland areas neighboring the aquatic adult habitat. Eggs are buried in excavated nests and left unattended to hatch approximately two months later. Water management and reservoir operation make many local wetlands unsuitable for turtles for a variety of reasons. Reclamation of valley floor wetlands and marshes as well as the channelization of most valley floor streams and rivers has resulted in such significant habitat loss that few extant pond turtle populations are now known from Tulare County. Southwestern pond turtles were seen during the 1993 field survey as they basked on logs and other objects in a pond at LSID-Northwest and at the edge of the Lower Kaweah River (at LSID-Northwest, and at Kaweah Oaks Preserve-East). Pond turtles probably also occurs along the St. Johns River.

Hardhead (*Mylopharodon conocephalus*) is a California Species of Special Concern. These large native minnows, which may attain a total length of nearly 2 feet, feed on bottom dwelling invertebrates and aquatic plants. Like most native fish species, hardheads are now rare in the Central Valley. They persist in small numbers on the Valley floor only where permanent water is maintained (Stan Stephens, pers. comm.). Although still present in some numbers, the hardhead is presently encountering stiff competition for the bottom invertebrate food resource from such introduced species as the inland silverside (*Menidia beryllina*).

Kern Brook Lamprey (*Lampetra hubbsii*) is a Category 2 candidate for federal listing and California Species of Special Concern. This species is endemic to the San Joaquin River Drainage; but has also been observed in the lower reaches of the Merced, Kings, and San Joaquin Rivers and in the Friant Kern Canal. This species was first described in 1976, and very little information has been complied about its life history and overall distribution. Kern brook lamprey was collected on the Lower Kaweah River by a research team from California State University, Fresno in 1987.

Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) is a Federally listed Threatened insect species that is restricted to scattered stands of elderberry (*Sambucus* spp.) shrubs in riparian communities of the Central Valley. In spring, adult Valley elderberry longhorn beetles (VELB) feed and lay eggs on elderberry shrubs. Larvae bore into the pithy core of the elderberry stems and, perhaps for as long as two years, mine passages in the wood as they feed. They then metamorphose into adults and emerge into the sunlight. There are many groves of robust elderberries within the Kaweah Corridor Study Area but VELB exit holes were only observed in stands of elderberries at the Charter Oak site and at the Cutler Park-North site during the 1993 field survey. Dennis Haines (pers. comm.) has also found VELB exit holes in elderberries at McKays Point.

Valley Sagittaria (*Sagittaria sanfordii*) is listed as a Category 2 candidate for Federal endangerment. This plant species occurs along sloughs and sluggish streams and freshwater marsh throughout the lower San Joaquin Valley. The channelized nature of the streams in the Kaweah River Corridor probably preclude this species.

Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), Swainson's hawk (*Buteo swainsoni*), Northern harrier (*Circus cyaneus*), black-shouldered kite (*Elanus caeruleus*), bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), prairie falcon (*Falco mexicanus*), and American peregrine falcon (*Falco peregrinus anatum*) are 11 raptor species that occur on an annual basis in the Study Area. Of these species, only Cooper's hawk and black-shouldered kite (probably breeding this year in the vicinity of the Terminus Dam afterbay) were found during the 1993 survey season. Cooper's hawks are still relatively common transients and winter visitors (August through April) in many habitats on the Valley floor of Tulare County. While Cooper's hawks rarely nest on the Valley floor, riparian groves (chiefly of cottonwood or alder) are the characteristic lowland breeding habitat in this part of California. Cooper's hawk probably nested this year in the eastern portion of the Study Area where an adult was seen on 7 June 1993. The breeding status of this species is of primary concern in Tulare County. Nest sites, when discovered, are worthy of protection as they are sensitive to disturbance.

Only the two *Accipiter* species (which are frequently seen hunting in this kind of habitat in the Central Valley during winter months) and black-shouldered kites occur in local riparian areas with annual regularity. The other 9 raptor species may occasionally be seen perching, roosting, or foraging across riparian habitat in the Study Area but they are most apt to simply pass overhead during migration or en route between parcels of more suitable habitat elsewhere.

A pair of golden eagles (normally restricted to rugged foothill and mountain habitat for breeding in Central California) nested in a tall sycamore on the LSID-Northwest site in 1992 (Steve Fesperman, pers. comm.). This type of breeding record is indicative of the low level of disturbance that occurs on much of the riparian habitat in the Study Area.

CNDDB classifies most of these raptor species as Species of Special Concern (no legal status) but the bald eagle and peregrine falcon are both State and Federally listed Endangered. Bald eagles occur sporadically along the St. Johns and Lower Kaweah Rivers where they hunt for fish and waterbirds chiefly between November and April. Most local sightings of peregrine falcons (there are very few local records) are of transient birds seen only occasionally, as small numbers of this rare falcon migrate through this area in spring and fall. Swainson's Hawk is listed as Threatened in California and is classified as a Category 2 Candidate for Federal listing. This species is now very rare as a summer breeder along the east side of the Central Valley. Most individuals seen in the Study Area are transients on their way to or from breeding territories in other parts of the northwestern United States.

San Joaquin Kit Fox (*Vulpes macrotis mutica*) is a Federally listed Endangered and State listed Threatened species. The delicately built, cat-sized San Joaquin kit fox is the smallest North American member of the dog family. These slender-built animals are characterized by relatively long legs and large, conspicuous ears. This species is mostly nocturnal, and hunts jackrabbits, cottontails, kangaroo rats, ground squirrels, and mice. Kit foxes were once common on the dry

plains of the San Joaquin Valley from the vicinity of Tracy in San Joaquin County, southward to southern Kern County.

In the 1970's, kit foxes were still denning along Cross Creek and Cottonwood Creek from east of Hanford into Tulare County as far east as Woodlake. Individual kit foxes have been observed in Ivanhoe and in the vicinity of Woodlake within the last five years. Most local reports of foxes probably refer to gray fox (*Urocyon cinereoargenteus*). Gray fox is more of a woodland animal than kit fox and readily climbs trees (Murie 1974). Its food also includes a considerable amount of vegetable material (Ingles 1965). Kit fox is much more of an open country predator than gray fox and seldom takes plant food. Except for desert cottontail, few of the common prey species sought after by Kit Fox (desert rodents such as kangaroo rats and lagomorphs such as jack rabbits) were noted in the Study Area. Although no kit fox sightings were made (during daytime surveys or nocturnal spotlighting) and no identifiable kit fox dens were found during the 1993 field survey, kit fox cannot be entirely ruled out as a species of possible occurrence in the Study Area.

3.4 Land Use

3.4.1 Historic Land Use

Historical descriptions of the Kaweah Corridor Study Area's natural vegetation, wildlife, and original hydrology provide a perspective with which to compare present conditions. As efforts are made to determine the current status of plant and animal species and to better judge the significance of natural habitat areas, these historical accounts also present a view of the potential for restoration and enhancement of native vegetation.

Grunsky (1898) made the following remarks about the St. Johns Channel of the Kaweah River:

> The [Kaweah] river has a perennial flow, but its flow is comparatively small at low stages, ordinarily about 30 second feet. The low water period usually begins in August and continues through January. The river is subject to freshets in the winter months, and is at its highest stages in April, May, and June. Medium stages are expected throughout February, March, and July.
>
> Four of the river channels -- Elbow Creek, Visalia or Mill Creek, Packwood Creek, and Deep Creek -- gave the name of "Four Creek Country" to the vicinity of Visalia. [Mill] Creek and Packwood Creek were the names given to the two water courses into which the main channel of Kaweah River separated 5 miles above Visalia. The course of [Mill] Creek was westerly through Visalia...
>
> The freshets of 1861-62 cut a new channel from a point on Kaweah River about 14 miles east of Visalia in a northwesterly direction toward and along the northern border of Kaweah River Swamp...and finally a connection was established with the Cross Creek Channel below Visalia, and thus St. Johns Channel of Kaweah River was permanently established.

In 1853, the Williamson Topographical Survey Party (Menefee,and Dodge,1913) gave an accurate account of the Kaweah Delta in its original state:

> Four Creeks: From the level of the arid and treeless plain...we made a sudden descent of about 10 feet to the bottom land of Four Creeks. Here the aspect of the landscape suddenly changed. Instead of the brown, parched surface of gravel, to which the eye is accustomed on the surrounding plains, we find the ground hidden from view by a luxuriant growth of grass and the air fragrant with the perfume of flowers. The sound of flowing brooks and the notes of the wild birds greet the ear in strange contrasts with the rattle produced by the hot wind as it sweeps over the dried weeds and gravel of the plain.
>
> The whole scene is overshadowed by groves of majestic oaks and the eye can wander down long avenues until lost in the shadows of their foliage. This scene of natural beauty is the result of natural irrigation, the ground being abundantly watered by the [Kaweah] which supplies the water that forms the Four Creeks...the profuse vegetation may not only be referred to the presence of water but to the fertility of the soil, which is alluvial and is frequently enriched by overflows of the Creeks.

In pre-settlement times, the levees of the Kaweah River were not substantial enough to keep it permanently confined to a given channel. This is one reason the forest described by Fremont and Derby was so extensive; periodic flooding had caused it to jump so often into new channels that it originally supported a much broader band of riparian vegetation. This broad, dense band of riparian vegetation included many more oaks than are present today.

Major loss of riparian habitat, from a number of sources, began to occur with the arrival of the first settlers. Valley oak, the dominant tree species in this riparian forest was also the most important tree to the wildlife along the river. These same trees, whose shade and abundant fuel had attracted the earliest settlers, had other important commercial values. Homer (1982) chronicles the conversion of riparian habitat to agricultural uses:

> These trees were cut, starting in the 1850's and 1860's, for split rail fences, to build log houses and outbuildings, and for firewood. Many were merely burned off to clear the fertile soil below them. Some were as much as a hundred and seventy feet in height, with a straight trunk up to thirty feet above the ground...
>
> The new settlers would burn out these brushy areas in the late fall when the ground and underbrush was dry. Their livestock would browse off the new vegetation the next spring when it came out again. The dropping water table also eliminated its growth away from the stream banks. The plow and disc kept it from coming back...

Even as late as the 1920's and 1930's there were still areas along the river where the native vegetation remained in a relatively undisturbed state (Latta 1949).

> During the spring of 1931...I made an exploration of the remaining jungle...along the Kaweah River. A dense portion of this area...had been burned over the previous fall and did not present one-third of the growth which had existed the year before. The search for large cottonwood trees...revealed several trees approximately four feet in diameter and of great height.
>
> Surrounding these large trees were great areas of wild blackberries and wild grapevines. Some of the grapevine trunks were six inches in diameter. They reached to the tops of the very tallest trees and then hung to the ground.
>
> By the latter part of September and the middle of October, the grapevines were loaded with grapes which were gathered by many nearby white and Indian residents for use in making jelly. Some areas, an acre or more in extent, were piled twenty feet or more in height with wild blackberry vines. During June, these had borne a tremendous crop of berries.
>
> In addition to the cottonwood and other trees mentioned, a variety of ash [Oregon or Swamp Ash] was quite common. There had also started a rather thick growth of young oaks.
>
> It would take several hours to catalog and describe the many varieties of grasses and water plants that in 1931 were growing in the tangled jungle along the banks of the main Kaweah River and its sloughs. Two or three varieties of these grasses are used by the local Indians in basket making, many of them growing to a height of eight feet or more and so thick that passage through them was made with difficulty. Great patches of nettle covered some portions. At other places wild hemp was quite thick.
>
> Over the burned area a young growth of blackberry and grapevines gave evidence that the next year would see several more acres covered to a great height with these plants.
>
> I have been assured by [some pioneers] that in some areas the oak growth was so thick that a team and wagon could not be driven between the trees, and that the branches overhead formed a closed canopy which shut out the sun entirely and offered refuge for countless numbers of birds and animals of all varieties.

It is difficult to estimate the extent of the oak forest prior to the arrival of the first American settlers. Jepson (1910) estimated that the Tulare Lake basin originally contained over 400 square miles of valley oak woodland and valley oak riparian forest. If all of the alluvial soils present within the Study Area supported valley oak woodland and riparian forest, then over 22,000 acres of woodland covered the Kaweah River Corridor. Relic trees scattered throughout the existing agricultural lands throughout the southern and western portions of the Study Area indicate that the occurrence of alluvial soils is strongly correlated with the historic presence of oak woodland.

Review of aerial photographs of the Kaweah Delta Water Conservation District taken in 1937 indicate that most of the oak woodland west of the Venice Hills had been converted to agricultural uses (see Figure 3-5). Large areas of oak woodland and grassland remained undeveloped to the east of the Venice Hills. Over 6,600 acres of grassland including the Venice Hills were present within the Study Area. No trees were present on the grassland areas underlain by terrace soils, but the bumpy topography characteristic of mima mounds or "hogwallows" was very apparent.

Approximately 10,800 acres of valley oak woodland and valley oak riparian forest was still present within the Study Area; however most of the dense riparian understory had been cleared to provide grazing land for cattle. Remnants of dense valley oak riparian forest remained in several locations along the Lower Kaweah River particularly in the vicinity of the SK Ranch, Kaweah Oaks Preserve, Yokohl, and Consolidated Peoples Ditch sites. Slightly more than 1,400 acres of dense valley oak riparian forest remained within the Study Area in 1937.

Mixed riparian forest dominated by western sycamore and Fremont's cottonwood was found on approximately 1,100 acres between McKays Point and Terminus. The riparian understory appeared to have been recently scoured by floodwaters as indicated by large white streaks of freshly deposited sand. The area above McKays point was probably flooded too frequently to support valley oak woodland.

3.4.2 Existing Land Use

Today, about 15 percent of the 37,000 acres in the Study Area remain undeveloped. Grassland is found on 1,850 acres of these natural lands, primarily in the Venice Hills. Oak woodland and valley oak riparian forest covers 2,600 acres and mixed riparian forest continues to cover about 1,100 acres. The rest of the land has been developed to agricultural and urban uses. Deciduous fruit and nut orchards and grape vineyards have been planted on most of land underlain by alluvial soils, while citrus and olives are the principal crops planted on the alluvial terraces. Two gravel mining operations have excavated large areas of land north of McKays Point.

Even though a significant amount of valley oak woodland and riparian forest remains along the Lower Kaweah River, the quality of the remaining habitat has been severely degraded by land use conversions for municipal, industrial and agricultural development. Probably less than 100 acres of dense valley oak riparian forest remain within the Study Area. Small stands of relatively pristine habitat remain at the Crocker, Jacob, and Kaweah Oaks Preserve sites.

HISTORICAL NATURAL COMMUNITIES

MIXED RIPARIAN FOREST

VALLEY OAK WOODLAND/ RIPARIAN FOREST

GRASSLAND

AREAS OF DENSE RIPARIAN FOREST

Source: Tulare County Library, 1937 Aerial Photos

KAWEAH RIVER DELTA CORRIDOR ENHANCEMENT STUDY

FIGURE 3-5

NORTH

SCALE = 1 : 69000

KASCO Environmental Consultants

Table 3-3
Comparison of Land Use Changes

Land Use	Pre-Settlement Acreage	1937 Acreage	Current Acreage
Oak Woodland/ Riparian Forest	19,900	10,800	2,600
Mixed Riparian Forest	1,100	1,100	1,100
Grassland	15,000	6,650	1,900
Agriculture/Urban	0	18,450	31,400
Total	37,000	37,000	37,000

Riparian communities have been eliminated or seriously altered throughout much of their original extent within the Kaweah River Corridor. Such changes have not eliminated valley oaks or other tree species from the riparian community but the growth rate of these trees has declined since the coming of irrigation to the Valley. The width of annual growth rings on valley oaks in Tulare County began to decline measurably after 1870 (Jepson 1910). The most significant changes in the riparian communities have resulted from the following changes in the local hydrology, all reflect the impacts of land use conversions for municipal, industrial and agricultural practices:

- completion of Terminus Dam (1962) and the subsequent changes in seasonality of in-stream flow;
- twelve decades of urban and agricultural diversions which have reduced the volume of in-stream flows; and
- lowering of groundwater levels in portions of the floodplains.

Some of the other man-made disturbances which have brought about a decline of riparian habitat include:

- removal of trees and understory with ax, saw, fire, and bulldozer;
- nearly 140 years of grazing and agricultural uses (which prevents seedling trees from becoming established);
- introduction of aggressive non-native plants, such as giant reed (*Arundo donax*), known locally as bamboo, and various Tamarisk (*Tamarix*) species.

Cattle grazing impacts both the age structure and the species composition of the riparian communities. Grazing prevents seedling trees from becoming established so most of the surviving trees are mature or senescent. This means that there has been and will continue to be a gradual decline in the number of trees as long as current grazing practices continue. This point is illustrated by the lack of young valley oaks on land that is continually grazed. For example, very few oak trees younger than 75-100 years of age were observed on any the LSID sites. Only grass is found on many of the grazed stream banks, where sandbar willow and berry vines would grow thickly in the absence of grazing.

As much as the local hydrology and land use has changed, the Lower Kaweah and St. Johns Rivers continue to support riparian vegetation; vegetation that is quite rich and vigorous where it has not been greatly disturbed. These plant communities were established with the avaliable seasonal waters that occured before urban and agricultural practices diverted flows. Evidence suggests that even though flows have been diverted and deposits of new flood-borne alluvial material are reduced, the banks of these streams are still receiving adequate water in some areas to keep this kind of habitat alive and vigorous.

Part Two - Section 4
Investigation of Alternative Sites

4.1 Consolidated Peoples Ditch (Paregien Ranch)

The Consolidated Peoples Ditch site occupies an area between Deep Creek and Johnson Slough just south of Highway 198, and covers an area of approximately 130 acres in Section 32, T18S, R26E, MDB&M. The majority of the site is currently not developed, the remainder is in row crops. Soils consist of Grangeville sandy loam and Kaweah fine sandy loam.

Site Features

Native tree canopy at this site consists of scattered valley oak (*Quercus lobata*), Western sycamore (*Platanus racemosa*), Fremont cottonwood (*Populus fremontii*), and Valley or black willow (*Salix gooddingii*). Non-native black locust (*Robinia pseudo-acacia*) and eucalyptus or blue gum (*Eucalyptus globulus*) also occur on site, primarily along the northern edge of the property along Hwy. 198, east of Deep Creek.

Understory plant species include southwestern or desert elderberry (*Sambucus mexicana*), California wild grape (*Vitis californica*), stinging nettle (*Urtica holosericea*), tree tobacco (*Nicotiana glauca*), California mugwort (*Artemisia douglasiana*), arroyo willow (*Salix lasiolepis*), sandbar willow (*Salix hindsiana*), Himalaya berry (*Rubus procerus*), buttonbush (*Cephalanthus occidentalis var. californicus*), and mule fat (*Baccharis viminea*). Ground cover consists of annual non-native grasses.

Notable vertebrate observations on the Paregien Ranch include red-tailed hawk, rufous-sided towhee, plain titmouse, Nuttall's woodpecker, acorn woodpecker, and black-chinned hummingbird.

Adequacy of Site

This site received an overall No. 1 ranking for habitat enhancement. One factor leading to this rank is this site's proximity to the Kaweah Oaks Preserve, which has excellent existing riparian habitat and is owned by The Nature Conservancy. As one of the stated goals is to expand on current habitat areas, rather than to create more "islands" of habitat (and therefore expand wildlife corridors within the Lower Kaweah River Delta Study Area), this site is deemed highly suitable for this project. This site also exhibits good historical habitat quality, which may increase its potential to return to a more natural condition. This site is located just south of Highway 198, which makes it highly accessible for passive recreation.

4.2 St. Johns River

The St. Johns River site occupies the bed of the stream from the railroad bridge near Rd. 180 downstream to the western boundary of Cutler Park. The site consists of approximately 40 acres in Sections 13, 23, and 24, T18S, R26E, MDB&M. All soils in this area are identified as riverwash.

Site Features

Grazing has impacted the understory of the narrow strip of riparian woodland in places.

Adequacy of Site

The St. Johns River site scored a No. 5 in the overall ranking. Historical aerial photos don't reveal a significant change in this area of the St. Johns; however, older historical accounts of this area would indicate that it was once much more densely vegetated than it is currently. Also, this would seem to be a relatively inexpensive alternative site for habitat enhancement since little or no revegetation work would be required. It is also fairly accessible to the public, and has close proximity to the City of Visalia.

4.3 LSID (Northeast)

The Lindsay-Strathmore Irrigation District (LSID)-Northeast site occupies the area to the north of the Lower Kaweah River and immediately east of Road 188. The site consists of 140 acres in Section 14, T18S, R26E, MDB&M. Lane Slough lies near the sites northeastern corner. Soils consist of Grangeville sandy loam (drained phase) and Kaweah fine sandy loam.

Site Features

Tree canopy species documented on site includes scattered valley oaks, Western sycamores, Fremont cottonwoods, and valley willows. Oregon ash (*Fraxinus latifolia*) and white alder (*Alnus rhombifolia*) were also present along the Lower Kaweah River north bank.

Understory consists mainly of annual non-native grasses with some herbs mixed in. Herbaceous species include some native Indian tobacco (*Nicotiana bigelovii*), panicled willow-herb (*Epilobium paniculatum*), narrow-leaved milkweed (*Asclepias fascicularis*), saltgrass (*Distichlis spicata*), and creeping wildrye (*Elymus triticoides*). The native wildrye occurs primarily on higher ground alongside draws.

The most densely vegetated area occurs just west of the railroad tracks. Cottonwoods, valley willows, elderberry, and arroyo willow make up the canopy in this area. Native California blackberry (*Rubus ursinus*), sandbar willow, and dense areas of creeping wildrye also occur here.

Notable vertebrate observations on this site include desert cottontail (*Sylvilagus audubonii*), western whiptail (*Cnemidophorus tigris*), western fence lizards (*Sceloporus occidentalis*), red-tailed hawk, turkey vultures, American kestrel, great-horned owl, northern orioles, western kingbird, nuttall's woodpecker, great egrets, and great blue heron. A great blue heron and great egret rookery was observed in 4 scattered sycamores, with at least 56 nests observed. At least 30 of the nests are south of the Lower Kaweah River on the LSID-Southeast site.

The more open areas of this property show evidence of consistent and heavy grazing, with no young trees and low species diversity. This also means that these areas have great potential for habitat enhancement.

Adequacy of Site

The LSID-Northeast site was ranked No. 4 overall. The presence of a heron and egret rookery on this site was a factor in its ranking, as was its proximity to the Kaweah Oaks Preserve, and its accessibility to the public for passive recreational purposes. A well-planned flooding and grazing regime could greatly encourage new tree and understory reproduction on this site.

4.4 LSID (Southwest) Site

The LSID-Southwest site is bounded by the Lower Kaweah River to the north and Avenue 304, the Consolidated Peoples Ditch to the south, and extends from the Santa Fe tracks near Yokohl Creek nearly to Lort Drive, on the Southern Pacific. It consists of 250 acres in Sections 14, 15, 22, and 23, T18S, R26E, MDB&M. Soils on the property are the same as described for the LSID-Northeast site.

Site Features

Tree canopy species documented on site include scattered valley oaks, Western sycamores, Fremont cottonwoods, and valley willows. Arroyo willow, red willow (*Salix laevigata*), buttonbush, and Oregon ash (*Fraxinus latifolia*) are also present. Several non-native species also occur on this site, and include tree-of-heaven (*Ailanthus altissima*), blue gum, osage orange, and palm.

Understory species include California wild grape, Himalaya blackberry, Indian tobacco, stinging nettle, California blackberry, and stinking gourd (*Cucurbita foetidissima*). Ground cover consists mostly of non-native annual grasses and milk thistle (*Silybum marianum*) with some wildrye and yellow star thistle (*Centaurea solstitialis*) mixed in. The edge of the Lower Kaweah River supports such wetland species as common tule (*Scirpus acutus*), rushes (*Juncus* sp.), panicled willow-herb, monkey flower (*Mimulus guttatus*), and horsetail (*Equisetum laevigatum*).
Notable bird species observed include ash-throated flycatcher, northern rough-winged swallow, rufous-sided towhee, California towhee, northern oriole, black phoebe, common yellowthroat, house wren, lazuli bunting, blue grosbeak, red-shouldered hawk, red-tailed hawk, and Western wood pewee. At least 35 tricolored blackbirds, a California Species of Special Concern, were observed flying southwest over the property. A barn owl was found dead on the ground adjacent to the pump house. Northern rough-winged swallows were observed on the south bank of Lower Kaweah River approximately 400 feet west of the closest pump house to Road 196. These swallows had probable nesting cavities 1 to 2 feet below the terrace top of the river in a nearly vertical sandy bank. Great blue herons were also present at a small rookery located in some western sycamores, and presumed nesting.

Other vertebrate species observed include two Western pond turtles (*Clemmys marmorata*), another State Species of Special Concern and Federal Candidate 2, basking on the north bank of the Lower Kaweah River approximately 500 meters east of the Deep Creek headgate. One additional Western pond turtle was observed on a dead alder in the river approx. 1/4 mile from the east end of the property. A long-tailed weasel (*Mustela frenata*) was also observed, 15-25' up in a Valley oak, raiding a European starling nest. One Western harvest mouse (*Reithrodontomys megalotis*) and its nest were also recorded on this site.

Adequacy of Site

The LSID-Southwest site exhibits a great diversity of both plant and animal life; however, little tree reproduction is occurring naturally. A combination of seasonal inundation of water and a compatible grazing regime could greatly enhance this site's habitat potential; however, this site was ranked No. 9, primarily because it appears to have always been oak woodland, and its current habitat condition is good. Historically, the habitat does not indicate much change (since 1937), and may be best left to its current land use for now.

4.5 LSID (Southeast) Site

The LSID-Southeast site is bounded to the north by the Lower Kaweah River, Avenue 304 and the Consolidated Peoples Ditch to the south, and extends from the Santa Fe tracks near Yokohl Creek eastward approximately 2,500 feet. It consists of 80 acres in Section 14, T18S, R26E, MDB&M. Soils are the same as those described for the previous two sites.

Site Features

Few trees occur on this site. Those that do are scattered and include Valley oak, Western sycamore, Fremont cottonwood, and valley willow. One white alder occurs on the south bank of the Lower Kaweah River. Understory species, occurring mostly along Rd. 196 and the railroad tracks, include California wild grape, Himalaya blackberry, California blackberry, mule fat, buttonbush, California mugwort, and arroyo willow. Creeping wildrye occurs near Rd. 196 and south of Consolidated Peoples Ditch in an area that does not appear as heavily grazed as the rest of the property.

Ground cover elsewhere is limited to non-native annual grasses, mixed with other herbs such as yellow star thistle, milk thistle, tarweed (*Hemizonia pungens*), and prickly lettuce (*Lactuca serriola*).

The LSID-Southeast site also supports a portion of the same great blue heron and great egret rookery that was described for the LSID-Northeast site. Other notable bird species observed on the site include red-tailed hawk (pairs and offspring), loggerhead shrike, tree swallow, belted kingfisher, and willow flycatcher.

Adequacy of Site

Flooding this site could have obvious benefits in that it could provide an immediate food source for the nesting herons and egrets on site. However, its overall rank is No. 6, primarily because the site did not appear to support significant riparian forest habitat in 1937.

4.6 Kaweah Oaks (West)

The Kaweah Oaks-West site is located between Deep Creek and the Tulare Irrigation District canal, directly north of Highway 198. It occupies approximately 150 acres in Section 29, T18S, R26E, MDB&M. Only a portion of this site is actually within the Kaweah Oaks Preserve. The majority of the site is agricultural lands and rural residences. Soils at this site consist of Grangeville sandy loam (drained phase) and Nord fine sandy loam.

EXISTING NATURAL COMMUNITIES

MIXED RIPARIAN FOREST

VALLEY OAK WOODLAND/ RIPARIAN FOREST

GRASSLAND

KAWEAH RIVER DELTA CORRIDOR ENHANCEMENT STUDY

FIGURE 3-6

NORTH

SCALE = 1 : 69000

KASCO Environmental Consultants

Site Features

The natural lands within the Kaweah Oaks-West site consists of extensive valley oak riparian woodland, and a large area of non-native grassland. The forest canopy along Deep Creek, historically quite dense, ranges from dense to fairly open. It is dominated by valley oak and western sycamore, and has a few cottonwoods, Oregon ash, and large willows. The agricultural portion of this site is planted in permanent crops, primarily deciduous fruit and walnuts.

Understory consists of shrubby valley willows, red willow, sandbar willow, arroyo willow, buttonbush, Himalaya berry, California blackberry, and a small amount of leather root (*Psoralea macrostachya*). Lianas consist of California wild grape and virgin's bower (*Clematis ligusticifolia*).

Ground cover within the riparian areas consists primarily of annual grasses with some creeping wildrye, Santa Barbara sedge (*Carex barbarae*), western ragweed (*Ambrosia psilostachya*), narrow-leaved milkweed, stinging nettle, and western goldenrod (*Solidago occidentalis*). Weedy herbs include milk thistle, bull thistle (*Cirsium vulgare*), and poison hemlock (Conium maculatum). The ground cover west of Deep Creek is almost all non-native annuals.

Notable wildlife includes coyote (*Canis latrans*), black bear (*Ursus americanus*) (rarely), gray fox (*Urocyon cinereoargenteus*), mink (*Mustela vison*) (rarely), western pond turtle, striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), broad-footed mole (*Scapanus latimanus*), long-tailed weasel (*Mustela frenata*), great blue heron (nesting), green-backed heron, wood duck (nesting), red-shouldered hawk (nesting), California quail, barn owl, great-horned owl, black-chinned hummingbird, acorn woodpecker, Nuttall's woodpecker, downy woodpecker, western wood-pewee, ash-throated flycatcher, plain titmouse, white-breasted nuthatch, Bewick's wren, house wren, western bluebird, loggerhead shrike, yellow-breasted chat (possibly breeding), black-headed grosbeak, blue grosbeak, lazuli bunting, rufous-sided towhee, California towhee, northern oriole, and song sparrow. One observer has also reportedly photographed ringtail (*Bassariscus astutus*) in the forest canopy along Deep Creek (Hansen, pers. comm.).

Adequacy of Site

The Kaweah Oaks-West site ranked No. 15 overall. The primary reason is that the natural lands within this site are already of excellent quality, and it is currently under protection. Only a small portion of this site is suitable for use as a detention and recharge basin. Developing the entire site would require the removal of several residences and permanent tree crops.

4.7 Kaweah Oaks (East)

The Kaweah Oaks-East site is located between Deep Creek, on the northwest, and the Consolidated Peoples Ditch and Johnson Slough on the southeast. It also lies directly north of Highway 198. This site consists of approximately 170 acres in Sections 28 and 29, T18S, R26E, MDB&M. Soils on this site are Grangeville sandy loam (drained phase) and Kaweah fine sandy loam.

Site Features

The Kaweah Oaks-East site consists primarily of extensive valley oak riparian woodland, an area of alkali meadow, and an area of non-native grassland.

The forest canopy along Deep Creek and Consolidated Peoples Ditch/Extension Ditch (historically quite dense), ranges from dense to open. It is dominated by valley oak and western sycamore (especially along Deep Creek), and has a few Fremont cottonwoods, Oregon ash, and large willows. Understory consists of valley willows, red willow, arroyo willow, sandbar willow, buttonbush, Himalaya berry, and California blackberry. Lianas of California wild grape and virgin's bower are also present.

Ground cover is similar to that at Kaweah Oaks-West (see above). A noteworthy alkali meadow community (no woody vegetation is present here) exists on the upland area between the bottomlands of Deep Creek and Consolidated Peoples Ditch/Extension Ditch. The high water table between the two channels supports alkali meadow perennials such as saltgrass, clustered field sedge (*Carex praegracilis*), Yerba mansa or coneflower (*Anemopsis californica*), alkali heliotrope (*Heliotropium curassavicum*), alkali sacaton bunchgrass (*Sporobolus airoides*), and nitrophila (*Nitrophila occidentalis*). Alkali barley (*Hordeum depressum*) is an abundant native annual grass in this plant community. West of this alkali meadow community, non-native annual grasses dominate.

Wildlife in this area is similar (no black bear, ringtail, yellow-breasted chat, or nesting red-shouldered hawk or great blue heron) to that of the Kaweah Oaks-West site. In addition, black-shouldered kite, willow flycatcher (transient), phainopepla, mountain bluebird, yellow warbler (potential breeder), southern alligator lizard (*Gerrhonotus multicarinatus*), and California legless lizard (*Anniella pulchra*) are present.

Adequacy of Site

This sites overall rank is No. 12. The site is currently under managed protection and is an excellent existing quality. The reason it ranked higher than the Kaweah Oaks-West site (No. 15) is because of the large non-native grassland area east of Deep Creek on the preserve. This grassland area is best suited for seasonal inundation and in greater need of habitat enhancement than surrounding areas on the preserve. Appropriately timed flooding of portions of this site would increase the species richness of the riparian forest by fostering reproduction of cottonwoods and willows from seed.

4.8 Crocker Environmental Habitat

The Crocker Environmental Habitat lies between the bank of the Lower Kaweah River and the Southern Pacific Railroad near the center of Section 21, T18S, R26E, MDB&M. It consists of 5 acres, and the soils are of Grangeville sandy loam (drained phase).

Site Features

The Crocker Environmental Habitat site is densely vegetated, with very little open ground. It is one of the best examples of Great Valley valley oak riparian habitat within the Study Area. Tree species present include valley oak, Fremont cottonwood, valley willow, arroyo willow, sandbar willow, and English walnut (*Juglans regia*). Lianas include California wild grape and virgin's bower. Understory species include elderberry, leather root, and Indian hemp (*Apocynum cannabinum*).

Bird species observed on this site are indicative of very high quality riparian systems, and include red-shouldered hawk, common yellowthroat, black phoebe, rufous-sided towhee, Bewick's wren, Nuttall's woodpecker, downy woodpecker, American goldfinch, plain titmouse, bushtit, ash-throated flycatcher, black-headed grosbeak, northern oriole, red-tailed hawk, scrub jay, and northern flicker. A striped skunk (*Mephitis mephitis*) and several western whiptail lizards were also observed on site.

Adequacy of Site

As previously stated, this site offers the best example of riparian habitat observed during the field surveys, and could act as a model for future habitat enhancement areas. Enhancement efforts on this site would be limited, as it is already in excellent condition. The only way to enhance this site would be to expand it and to remove non-native species. This site ranked No. 16 overall, primarily because of its small size and inaccessibility to the general public. While this site does not appear to satisfy the objectives of this project, it may satisfy the objectives of the Wildlife Conservation Board (such as mitigation for loss of other riparian habitat areas) for longterm acquisition or protection..

4.9 Deep Creek Environmental Habitat

The Deep Creek Environmental Habitat site occupies a triangular parcel at the point of divergence of Lower Kaweah River and Deep Creek; it is to the east of the Southern Pacific Railroad. It consists of approximately 15 acres in Section 21, T18S, R26E, MDB&M. The soils present at this site are Grangeville sandy loam (drained phase) and Nord fine sandy loam.

Site Features

The Deep Creek Environmental Habitat site is very small (15 acres), and the understory has been mostly disturbed. Although a number of valley oaks are found on this site, the understory has been cleared for rowcrop farming, and irrigation sprinklers have been installed, leaving only the river's edges and railroad easement undisturbed. There is a large home in the center of the site. The undisturbed areas, however, are of good quality habitat.

Dominant tree species are valley oak, arroyo willow, and sandbar willow. Understory consists of elderberry, tree tobacco, California mugwort, Indian tobacco, California blackberry, poison hemlock, western ragweed, California wild grape, and wild licorice (*Glycyrrhiza lepidota* var. *glutinosa*).

Because of its proximity to the Crocker Environmental Habitat site, many of the same bird species were recorded for this site as well. Additional observations include common raven, brewer's blackbird, great blue heron, cliff swallow, American robin, and blue grosbeak.

Adequacy of Site

The overall rank for the Deep Creek site is No. 14, primarily due to its size. As mentioned above, there is one home on this site. Also, the railroad easement through the area already provides some continuity to Crocker Environment Habitat, and also to the Jacob (McCain) property and the LSID-Northwest site to the northeast. However, except for the presence of the

home on the site, Deep Creek Environmental Habitat has great potential for riparian enhancement.

4.10 Monrovia Reservoir

The Monrovia Reservoir (Nursery) site lies along the St. Johns River immediately upstream from the notch in the Venice Hills through which the river passes. It occupies approximately 190 acres in Sections 9 and 16, T18S, R26E, MDB&M. The west side of the dam and reservoir would be adjacent to the Tulare Irrigation District canal. The Packwood Canal runs through the east side of the dam site and the reservoir area. Soils within the reservoir area are composed of Grangeville sandy loam, while the St. Johns River bed is composed of riverwash.

Site Features

The Monrovia Reservoir site consists primarily of highly improved agricultural lands. Tree canopy at this site consists of scattered valley oaks, western sycamore, valley willow, and cottonwoods. Arroyo willow is also present. Understory consists mainly of tree tobacco, Indian tobacco, Himalaya blackberry, California blackberry, mule fat, California mugwort, buttonbush, sandbar willow, elderberry, poison hemlock, California wild grape, and stinging nettle. It is important to note that the above-mentioned plant species occur only along the banks of the St. Johns River.

Ground cover consists of annual non-native grasses and other herbs, including milk thistle, narrow-leaved milkweed, tarweed, tolguacha or jimson weed (*Datura meteloides*), and doveweed (*Eremocarpus setigerus*).

Notable vertebrate species observed on this site include red-tailed hawk, black phoebe, northern rough-winged swallow, common raven, barn swallow, great blue heron, great egret, California quail, and black-headed grosbeak.

Adequacy of Site

The primary factor in ranking this site so low (No. 17 overall), was the expense that would be required to return this site to even a semi-natural condition. Historical photo evaluation revealed that this site may not have supported an extensive riparian forest in the past.

4.11 LSID (Northwest)

The LSID-Northwest site is bounded to the south by the Lower Kaweah River, and partially to the northwest by Road 188. It covers approximately 230 acres in Sections 15 and 22, T18S, R26E, MDB&M. Soils are similar to those at the previous three LSID sites.

Site Features

Tree canopy at this site is fairly extensive, with a good quality mature valley oak woodland on a terrace west of the west fence line. Tree species include valley oak, valley willow, western sycamore, Oregon ash, arroyo willow, red willow, and a few standing dead white alders. The dead alders support extensive vines of California wild grape. Non-native walnut and fig trees are also present.

Understory species consists of elderberry, California blackberry, California rose (*Rosa californica*), stinging nettle, poison hemlock, and tree tobacco. Open areas are dominated by non-native annual grasses, in addition to tarweed, yellow star thistle, milk thistle, creeping wildrye, saltgrass, and Indian tobacco. Some native alkali sacaton bunchgrass (*Sporobolus airoides*) is also present along Avenue 320. Also, an extensive area of extremely dense milk thistle is present north of the Lower Kaweah River.

Some notable bird species observed on this site include Western meadowlark, loggerhead shrike, red-tailed hawk, northern oriole, acorn woodpecker, California quail, lazuli bunting, blue grosbeak, ash-throated flycatcher, and bushtit. In addition, 23 wood ducks were observed leaving a large willow-lined pond on this site. A golden eagle nested in a sycamore on this site in 1992 (Steve Fesperman, pers. comm.).

Western pond turtles were observed also on this site. One was observed in a small pond; five other individuals were basking in the large pond where the wood ducks were seen. Several large red and valley willows provide dense cover at the large pond, while duckweed (Lemna minor) covers the water surface.

Adequacy of Site

The LSID-Northwest site ranked No. 2 overall for habitat enhancement potential. The two major factors in this determination are its proximity to the Kaweah Oaks Preserve, and the projected low cost for enhancement on this site. Historic aerial photos reveal dense riparian forest on portions of the site. It is an excellent candidate for acquisition and protection, as several Western pond turtles, wood ducks, and other notable species present indicate a valuable natural resource. Another desirable feature of this property is its transition to upland habitat (foothill grassland) on its northwest side. This upland transition could serve as a "refugia" for mammals and other wildlife during seasonal inundation periods.

4.12 LSID (Farmed Land)

The LSID-Farmed land site occupies 120 acres in the southwest quarter of Section 11, T18S, R26E, MDB&M. Its west boundary is Road 188, and Lane Slough runs diagonally through the site. Ketchum Ditch runs along its western side. The soils present are mostly Grangeville sandy loam (drained phase), but a few acres of Tujunga loamy sand occur next to Road 188 at the northwest corner of the site.

Site Features

This site is currently planted in row crops, with only a few ruderal (or weedy) plant species existing along the site perimeter.

Adequacy of Site

Habitat and wildlife enhancement at this site would be far too costly and labor intensive for reasonable consideration. As no natural topography or vegetation exists at this site, the LSID-Farmed land site would require extensive revegetation effort for enhancement, and would be very costly to recreate a semi-natural environment. Its overall rank is No. 19.

4.13 Yokohl Creek

The Yokohl Creek site is located north of Lower Kaweah River and immediately east of the LSID-Northeast site. It consists of approximately 80 acres in Section 14, T18S, R26E, MDB&M. Soils are composed of Grangeville sandy loam (drained phase) and Kaweah fine sandy loam.

Site Features

The Yokohl Creek site is similar to the LSID-Northeast site with respect to tree canopy and the major understory components. However, the open pasture areas differ somewhat in plant species composition, and appear to be much wetter overall. Milk thistle is more abundant here, as is stinging nettle. Other species present include Italian ryegrass (*Lolium multiflorum*), mayweed (*Anthemis cotula*), white lawn clover (*Trifolium repens*), curly dock (*Rumex crispus*), and birdsfoot lotus (*Lotus corniculatus*).

The river bank along the north side of the Lower Kaweah River, near the eastern edge of LSID-Southeast, is relatively bare (no trees).

Notable vertebrate species on this site include red-tailed hawk, turkey vulture, blue grosbeak, green-backed heron, great-horned owl, northern oriole (3 nest-mate fledglings near Lower Kaweah River), and black phoebe. Great egret and 8 great blue herons were observed within the river channel and along the banks. These birds were probably nesting at the rookery on the LSID-Northeast/Southeast sites.

Adequacy of Site

The Yokohl Creek site was ranked No. 7 overall. This site exhibited a very good historical habitat quality, and cost to enhance the current quality would be moderate to low. Some revegetation along the Lower Kaweah River and some eradication of non-native plant species would be necessary; however, doing so could help restore what was historically one of the densest groves of riparian forest on the Lower Kaweah Delta.

4.14 S. K. Ranch

The S. K. Ranch site is situated to the south of the Lower Kaweah River and to the east of Highway 245, to about 430 feet at the east edge of the property. It consists of 300 acres in Sections 7 and 18, T18S, R27E, MDB&M. Soils are comprised of Grangeville silt loam (drained phase), Tujunga sand, and San Joaquin loam.

Site Features

Most of the S. K. Ranch site is currently planted in row crops. A few valley willows are present along the Lower Kaweah River, which is highly channelized at this location.

Adequacy of Site

This is a poor location for habitat and wildlife enhancement for the same reasons discussed under 4.12. However, the historical photos revealed a dense riparian forest canopy on this site. This information coupled with the sites hydrology and soils, gives it a fairly high enhancement

potential. A relatively high cost to develop the site was also considered. The overall rank assigned to this site is No. 11.

4.15 Lort Drive

The Lort Drive site lies between Lort Drive and the Consolidated Peoples Ditch, just east of the Southern Pacific Railroad. The site covers an area of approximately 115 acres in Sections 21, 22, and 27, T18S, R26E, MDB&M, is currently undeveloped and used as cattle pasture. Soils consist of Cajon fine sandy loam (Storie 1940).

Site Features

The Lort Drive site is one of the finest, most extensive alkali sacaton grassland/alkali meadow habitats in the Study Area. Canopy and understory at this site are nearly nonexistent. Ground cover consists of native annuals with a significant component of alkali sacaton bunchgrass, saltgrass, scattered coneflower (or Yerba mansa), nitrophila, and clustered field sedge.

Adequacy of Site

Review of historical aerial photos indicate the this site may never have supported riparian or oak woodland vegetation. The presence of sacaton bunchgrass indicates that the soils may have been too saline and the historic water table too high for valley oaks to occur on this site. Flooding of this site could be done to enhance meadow perennials, but should not be pursued as a riparian enhancement effort. The ranking for this site is No. 20.

4.16 Hannah Ranch

The Hannah Ranch site is located between the St. Johns and Lower Kaweah Rivers, east of Highway 245 (Road 212). It consists of 775 acres in Sections 5, 6, 7, and 8, T18S, R27E, MDB&M. Soils consist of Grangeville silt loam (drained phase) and Tujunga sand.

Site Features

The Hannah Ranch site is primarily planted into row crops. The only exception is the easternmost 20 acres, which consists of a sandy mound. This sand mound was created following flood years when deposited sand from the surrounding farmed land was scraped together and left where it is today. The primary vegetation in this area today is elderberry.

Adequacy of Site

The Hannah Ranch site would require extensive revegetation efforts for wildlife and habitat enhancement, and would be very costly to recreate a semi-natural environment. It ranks No. 18 overall.

4.17 Kaweah River

The Kaweah River site is located directly east of the S. K. Ranch and south of the Lower Kaweah River. It consists of approximately 160 acres in Sections 8 and 9, T18S, R27E, MDB&M. Tujunga sand and riverwash are the dominant soils, with some Grangeville silt loam (drained phase) occurring in the south and easternmost edges.

Site Features

Few valley oak trees occur along the river at this site. Understory consists of irrigated pasture.

Adequacy of Site

The Kaweah River site is ranked No. 13 overall. Aerial photographs from 1937 reveal a good historical habitat quality. A moderate cost to enhance this site is expected for revegetation.

4.18 Cutler Park-North

The Cutler Park-North site occupies an area between St. Johns River and Matthews Ditch, just east of Oak Ranch, and covers an area of approximately 225 acres in Sections 15, 22, and 23, T18S, R25E, MDB&M (approximately 160 acres of this site lie west of the Study Area boundary). The site, which consists mostly of abandoned orchard, is currently not developed. Soils consist of Cajon fine sandy loam and Tujunga sand (Storie 1940).

Site Features

Canopy here is open with scattered valley oaks with evidence of a recent burn (some dead and fire-damaged trees). Some old fruit trees from an abandoned orchard also grow on this site. Ground cover includes some native annual species such as miniature lupine (*Lupinus bicolor*), *Phacelia* sp., and purple owl's clover (*Orthocarpus purpurascens*). The best vegetation occurs nearest the St. Johns River.

Notable vertebrate species present on this site include Nuttall's woodpecker, acorn woodpecker, black-chinned hummingbird, western kingbird, ash-throated flycatcher, bushtit, black phoebe, American kestrel, barn swallow, cliff swallow, and American robin. Some elderberry plants on this site have valley elderberry longhorn beetle exit holes.

Adequacy of Site

This site has high restoration enhancement potential because of existing water conveyance systems and favorable topography. The Cutler Park-North site is ranked No. 3 overall. Although restoration costs are expected to be moderate, this site shows good historical habitat quality.

4.19 Charter Oak

The Charter Oak site occupies a relatively narrow curvilinear reach of the St. Johns River (both the north and south banks) between the Packwood Canal crossing and the point where the St. Johns River veers west away from the Southern Pacific Railroad. The site covers an area of approximately 50 acres in Section 17, T18S, R26E, MDB&M, and is mostly undeveloped river bank. Soils consist of Cajon sandy loam, Honcut silty clay loam, and San Joaquin loam (Storie 1940).

Site Features

The canopy at this site is often quite dense with a good native species richness, but understory is variable depending on grazing presence or absence. Valley oaks dominate, but valley willow,

arroyo willow, and Fremont cottonwood also occur. The streambank cover of Himalaya blackberry, California wild grape, tree tobacco, California blackberry, and elderberry provides valuable riparian cover.

Groundcover species include mule fat, California mugwort, poison hemlock, jimson weed, lambsquarters (*Chenopodium album*), horehound (*Marrubium vulgare*), western goldenrod, spanish clover, doveweed, and creeping wildrye.

Notable vertebrates observed on the Charter Oak site include broad-footed mole, Botta's pocket gopher, California quail, northern flicker, acorn woodpecker, northern oriole, Anna's hummingbird, black-chinned hummingbird, American robin, and American kestrel. In addition, 3 fledgling and two adult red-tailed hawks were observed in the vicinity of a nest within a large valley oak. Greater roadrunner was also observed on site.

Adequacy of Site

The Charter Oak site is ranked No. 10 overall. Of primary considerations regarding this site were its size (small), and its historical quality. The site does not appear to have changed much over the years, maintaining an overall good quality riparian forest habitat.

4.20 Jacob (McCain) Ranch

The Jacob Ranch site occupies an area between Lower Kaweah River and Ketchum Ditch, just west of the LSID-Northwest site, and covers approximately 320 acres in Sections 15, 21, and 22, T18S, R26E, MDB&M. Approximately 230 acres of the Jacob Ranch are developed into plum orchards, about 8 acres are fish ponds, and the remaining 80 acres are open to dense riparian forest. Soils consist of Cajon sandy loam (Storie 1940).

Site Features

The tree canopy at this site is among the most dense in the Study Area, with a high proportion of mature valley oaks. The most notable understory plant species are wild rose and leather root.

Notable vertebrate species on this property include great blue heron, rufous-sided towhee, downy woodpecker, western bluebird, wood duck, and gray fox.

Adequacy of Site

Seasonal inundation of this site could offer excellent wood duck nesting habitat and an opportunity for a high quality closed canopy riparian forest with dense understory. However, access to the site is limited, giving it poor recreational potential. The overall ranking for the Jacob site is No. 8.

Part Two - Section 5
Summary and Recommendations

5.1 Ranking of Alternative Sites

Upon completion of the field surveys and data review all of the potential sites were independently evaluated by the project biologists. A matrix comparison of the potential sites was prepared by each biologist using the selection criteria described in Section 2.3. The sites were then evaluated for overall enhancement suitability without regard to factors such as size or suitability for groundwater recharge or flood control. After the sites had been categorized for enhancement suitability, they were ranked from best to worst by each of the three biologists. In the ranking analysis, factors such as size, contiguity with protected riparian habitat, and suitability for flood storage and recharge may have been used to differentiate closely ranked sites.

All of the potential sites considered in the study had suitable soils and hydrology to support riparian woodland (see Table 5-1). Therefore, the most important factors for evaluating overall enhancement suitability the comparison of historical to existing habitat quality, recreation value and management costs. Generally, the overall enhancement value was higher for sites which had good historical habitat, fair existing habitat, and low to moderate management costs. Sites such as the Kaweah Oaks Preserve, which still support excellent riparian habitat and are already protected, did not have good potential for riparian enhancement since their is little room for improvement.

The results show that restoration of riparian habitat can be accomplished almost anywhere within the Kaweah River corridor, including agricultural lands. However, the costs of acquisition and intensive management required to restore agricultural land make these alternatives impractical in light of much more feasible alternatives on existing natural lands. It is more difficult to find sites with the appropriate topography, hydrogeology and surface water hydrology that will enable the construction of flood storage and groundwater recharge facilities than it is to find sites where riparian habitat can be enhanced or restored. Therefore, greater weight should be given to sites which can provide good flood control and recharge benefits.

5.2 Suitability of Sites for Recharge and Flood Control

Several of the alternative sites evaluated in the Kaweah Corridor Study appear to have good potential to meet all three project objectives: riparian habitat enhancement, ground water recharge and flood control storage. Of the sites ranked in the top eight for recharge and flood control, five were also in the top eight for riparian enhancement (see Table 5.2).

Surprisingly, the Consolidated Ditch site was selected as the top-ranked site in both the Part One and Part Two studies. This site offers good habitat enhancement potential and is contiguous with existing protected habitat on the Kaweah Oaks Preserve. Four of the six sites owned by the Lindsay-Strathmore Irrigation District ranked highly in both studies and are well suited to meeting all three project objectives. The LSID-Southwest site was not as highly ranked for

TABLE 5-1

PART TWO COMPARISON OF SITE ALTERNATIVES

Site No.	Site Name	Soils	Hydrology	Historical Habitat Quality	Current Habitat Quality	Recreation Value	Protection Potential	Management Costs	Overall Enhancement Potential	Site Ranking
1	Consolidated Peoples Ditch	Good	Fair	Good	Fair	Good	High	Moderate	Good	1
2	St. Johns River	Good	Good	Fair	Good	Good	High	Low	Good	5
3	LSID-Northeast	Good	Good	Good	Good	Good	High	Low	Good	4
4	LSID-Southwest	Good	Good	Fair	Good	Good	High	Low	Fair	9
5	LSID-Southeast	Good	Good	Good	Fair	Good	High	Low	Good	6
6	Kaweah Oaks-West	Good	Good	Good	Good	Good	Low	High	Fair	15
7	Kaweah Oaks-East	Good	Good	Good	Excellent	Good	Low	Low	Fair	12
8	Crocker Envir. Habitat	Good	Good	Good	Excellent	Poor	High	Low	Fair	16
9	Deep Creek Envir. Habitat	Good	Good	Good	Fair	Poor	High	Moderate	Fair	14
10	Monrovia Reservoir	Good	Good	Fair	Poor	Good	High	High	Poor	17
11	LSID-Northwest	Good	Good	Good	Good	High	Low	Low	Good	2
12	LSID-Farmed	Good	Good	Fair	Poor	Good	High	High	Poor	19
13	Yokohl Creek	Good	Good	Good	Fair	Poor	High	Moderate	Good	7
14	S. K. Ranch	Good	Good	Good	Poor	Good	High	High	Fair	11
15	Lort Drive	Good	Fair	Fair	Fair	Good	High	Moderate	Poor	20
16	Hannah Ranch	Good	Fair	Fair	Poor	Good	High	High	Poor	18
17	Kaweah River	Good	Good	Good	Fair	Poor	High	Moderate	Fair	13
18	Cutler Park-North	Good	Fair	Good	Fair	Poor	High	Moderate	Good	3
19	Charter Oak	Good	Good	Good	Good	Good	High	Low	Good	10
20	Jacob (McCain) Ranch	Good	Good	Good	Excellent	Poor	High	Low	Fair	8

habitat enhancement potential due to evidence that it may not have supported significant riparian forest habitat in the past.

Three sites that were highly ranked in the Part One study did not score well in Part Two: Monrovia Nursery, Kaweah Oaks-East and Kaweah Oaks-West. The Monrovia Nursery site ranked 17th out of 20 sites evaluated in the Part Two study, primarily because it probably did not support significant riparian forest habitat in the past and management costs to restore riparian habitat on this site would be very high. The Kaweah Oaks sites were not highly ranked because they already support excellent riparian forest habitat and are protected by an organization with strict conservation policies.

Two other sites which were highly ranked for riparian enhancement suitability and had high potential benefits for groundwater recharge were Cutler Park-North and the St. Johns River. The St. Johns River site was not highly ranked in the Part One study because of high operation costs per acre foot of groundwater recharge and the Cutler Park-North site was eliminated from consideration because of potential interference with leach fields in the neighboring Oak Ranch subdivision.

TABLE 5-2

COMPARISON OF PART ONE AND PART TWO RANKINGS

Site No.	Site Name	Part One Ranking	Part Two Ranking
1	Consolidated Ditch	1	1
5	LSID (S.E.)	2	6
7	Kaweah Oaks (East)	3	12
4	LSID (S.W.)	4	9
10	Monrovia Reservoir	5	17
3	LSID (N.E.)	6	4
11	LSID (N.W.)	7	2
6	Kaweah Oaks (West)	8	15

5.3 Sites Suitable for Riparian Enhancement or Acquisition

Several sites which were not highly ranked for flood control or recharge benefits in the Part One study are good candidates for acquisition and enhancement projects. These sites could be considered for projects which do not have other water use components or as mitigation sites for projects which will impact riparian habitat elsewhere. Sites which have good potential for habitat enhancement are sites which formerly supported good riparian habitat that is now degraded. Potential acquisition sites are sites which currently support excellent riparian habitat but have no long term protection.

Three sites were deemed to have good potential for riparian habitat enhancement: Yokohl Creek, Charter Oak, and SK Ranch. Aerial photographs from 1937 indicate that all of these sites supported high quality riparian forest habitat. Changes in hydrology, grazing, firewood cutting and conversion to intensive agriculture have dramatically reduced or eliminated the amount of riparian vegetation currently found on these sites. The SK Ranch site is included in this group of sites because it supported one of the most extensive stands of riparian forest remaining within the Kaweah River Corridor in 1937.

Another two sites were identified as having good potential for acquisition: Jacob Ranch and Crocker Environmental Habitat. These sites along with the Kaweah Oaks Preserve, contain some of the best examples pristine riparian forest habitat remaining within the Study Area. The ownership and future development plans for these sites should be investigated further so that protection and/or acquisition strategies can be developed.

5.4 Recommendations for Further Action

The results of the preliminary investigation indicate that there are a number of sites within the Kaweah River corridor which can meet all three objectives of a conjunctive use project. The following recommendations for further action could be undertaken in the next phase of the project.

Detailed Site Analysis

Further biological assessment could be performed on the best alternative sites. This could include detailed vegetation mapping and inventory of existing trees and trapping and tagging or banding of animals to establish baseline data for future evaluation of the projects.

Develop Management Strategies

As designs for project facilities begin to take shape, the project biologist should begin to develop management strategies that will be consistent with the operation of detention and groundwater recharge facilities. Riparian enhancement strategies should be incorporated in project design, when possible and preliminary management plans should be written for each site. These strategies would form the basis for an operations manual to accompany the demonstration project.

Prepare Riparian Resource Plan

Long term management of riparian resources within the Kaweah River corridor could be investigated in greater detail. This plan could address the interrelationships of project sites to each other and to other existing riparian habitat.

Part Two - Section 6
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6.2 Persons Contacted

Faubion, Rosalie. Project Biologist for the Bureau of Reclamation, Fresno Office. Fresno, California.

Fesperman, Steve. Local biologist, Woodlake, California.

Haines, Dennis. Invertebrate Pest Control Advisor, Tulare County Agricultual Commissioner, Visalia, California.

Hansen, Robert. Local Biologist, and former preserve manager for Kaweah Oaks Preserve, Visalia, California.

Heyne. Tim. Fisheries Biologist for the California Department of Fish and Game, Region IV Office, Fresno, California.

Kilburn, Bud. Hydrographer for the Kaweah Delta Water Conservation District, Visalia, California.

Kirkpatrick, John. Agribusiness Consultant, Kirkpatrick Ag Services, Visalia, California.

Presley, Gail. Regional Biologist for the California Department of Fish and Game, Region IV, Visalia, California.

Stephens, Stan. Fisheries Biologist for the California Department of Fish and Game, Region IV Office, Fresno, California.

Williams, Dan. Endangered Species Project Coordinator, Bureau of Reclamation, Fresno Office, California.

Table of Contents

APPENDICES FOR PARTS ONE AND TWO

Appendix A

Other Possible Alternatives (Not Selected for Evaluation in Part One)

Appendix A
Other Possible Alternatives
(Not Selected for Evaluation in Part One)

A - Dry Creek Area

Observations along Dry Creek Road as far as Terminus Dam indicate that the bedrock outcropping in the river bed area is not a very suitable area for ground water percolation. The river bed soils also look fairly tight and do not appear suitable for conservation practices.

B - Hannah Ranch Site - 775 Acres

The Hannah Ranch site, between the St. Johns and the Kaweah Rivers is currently planted into what looks to be winter wheat. The top soil looks very permeable. Water could be diverted from either river. Methods for ground water percolation could include:

1. Sprinkler system - with over irrigation
2. Berming for flood irrigation

It may be that the land could be jointly used for crop production and over irrigation for ground water percolation. However, the entire site is currently proposed for a gravel and aggregate extraction operation.

C - Kaweah River - 180 Acres

This site is located south of the Kaweah River in the north half of Block 8. It is not accessible at this time. The ownership of this property is unknown. Our general assessment is that it is too far east of Spruce Road (Road 212) for groundwater recharge. Also due to the proximity of bedrock and tight soils, this would not be a good site for consideration.

D - Giant Oak Ranch - 320 Acres

This site is all planted with permanent crops and does not appear to be suitable for a dam or reservoir consideration. The other problem with the Giant Oak Ranch site is that it is up stream from the Venice Hills where bedrock is exposed. The north end of the Monrovia Nursery is planted in alfalfa.

E - The Hatchery - 100 Acres

This site is currently open ground that is being farmed. The land elevation is approximately the same as at Road 180. Any utilization of this site would require berming all the way around it and upstream diversion for filling. It does not appear to be one of the better sites.

F - Cutler Park (North) - 40 Acres

This site is on the north side of the St. Johns River near Cutler Park. This area could be bermed up 2 to 3 feet to provide for flood control protection and is currently vacant land. This land is in

the flood plain and probably cannot be zoned residential. Water could be diverted into it out of the St. Johns for flood control protection. The soil appears to be highly permeable and suitable for percolation and retention. On the north side of this property, there is a levee to protect the Oak Ranch Housing Development, which could be used to help contain water. This site appears to be fairly good for flood control and ground water recharge. Value of this land is probably minimal since it is in the flood plain area. However, a major problem with this site would be with the Oak Ranch sewer septic tanks and leach lines. Raising the ground water table in this area could cause increased wastewater disposal problems for this neighboring development.

Appendix B

Minutes to the File (reference)

MEMORANDUM

TO: Minutes to the File

FROM: John W. Brown - CDM Sacramento

CC: Ginger Strong - City of Visalia
Dennis Keller - Keller/Wegley
Wm. Buchholz - CDM Walnut Creek
Robert Ford - CDM Sacramento
Lisa McDaniel - CDM Walnut Creek
Herb Knierim - KDWCD

DATE: February 12, 1993
REVISED: February 24, 1993

SUBJECT: Site Visit and Meetings, February 2, 1993

Following are notes taken at the above referenced site visit and several meetings:

MEETING WITH GINGER STRONG, CITY OF VISALIA [209/738-3522], AND DENNIS KELLER OF KELLER/WEGLEY, CONSULTING ENGINEERS [209/732-7938].

- Project (Part One) is to be developed with specific tasks and target dates as identified in CDMs Proposal.
- Tulare County Flood Control District will be a player and can provide project input.
- Tulare County is interested in habitat and mitigation sites for HCP.
- Visalia's primary interest is ground water recharge and flood control issues, associated with mitigation of urban development impacts.
- Study is to end at the East end of Cutler Park.
- The City of Visalia is 100% on ground water.
- Major areas of concern:

    1. Visalia agriculture lands are irrigated with approximately 70% ground water and 30% surface water. When the land is developed to urban, water is supplied 100% from the ground water and the surface water recharge benefit is lost from the land. This creates an additional drain on a ground water basin already being mined.

    2. Development from agriculture to urban removes trees and wildlife habitat. There needs to be additional wildlife habitat developed to offset habitat loss. An open space element of the general plan requires various setbacks from 25 to 100 feet.

- California Water Service, services the City of Visalia.

- The Kaweah and St. John's Rivers Association input needs to be provided in this study.
- The study needs to address who is the beneficial user of recharge sites in the Ivanhoe Exeter areas. Visalia may receive little benefit from recharge East of Spruce Road. Therefore, recharge sites for Visalia should primarily address sites West of Spruce Road.
- The Kaweah River may offer better recharge sites. For Visalia than the St. John's. Inflatable rubber dams on the Kaweah might be considered in that they do not take up agricultural land or infringe on open space.
- Farming areas may not be good recharge sites but could be used as contingent sites.
- Tulare Lake water users and others have water entitlements from Terminus Reservoir.
- The St. John's may have limited impact on this study, particularly from Cutler Park West into urban areas. St. John's appears to have lots of sand in the stream bed that is deep. The Cutler Park area, particularly, appears to be worthy of percolation basin sites.
- Water delivered from Terminus is pre-1914 water rights water.
- Agricultural interest want to keep the ground water basin as high as they can to reduce pumping cost.
- The ground water table responds quickly to recharge and pumping.
- It appears the basin under the City is not confined, and a consideration for groundwater would be for the City to use it or lose it to neighboring areas.
- Howard Marguleas and Bob Hawke sold the Martin Ranch to Paramont Farms. Bob Hawke has sold the surface water rights separately to the Tulare Irrigation District for approximately $100 per acre foot which removed the water from the land. Marguleas may do something similar with his share of surface water rights. Tulare Irrigation District may swap 5,000 acre feet of CVP water to Hawke for 5,000 acre feet of Terminus water. CVP water may be transferred out of the service area while the Terminus water cannot. It appears TID will purchase the surface water rights.
- Scott Edwards is the General Manager of Lindsey Strathmore Irrigation District.
- The Kaweah Delta Water Conservation District endeavors to buy surplus water for ground water recharge.
- Water is generally released from Terminus Reservoir 50 to 180 days a year.
- Check with DWR, Lou Beck, on blueline maps for the project area. Gene Winsett, technician in Dennis' office will supply CAD mapping information to CDM. CDM people to check with Gene on the CAD disk and how best to format.
- Visalia is having a storm water master plan developed by Boyle Engineering. Study is out for review.
- John Kirkpatrick [209/732-3422] is a local resident with and affiliated with the Kaweah and St. John's Farmers League. This league is concerned with proposed Kaweah River Rock gravel extraction plans out of the Kaweah.

SITE VISIT WITH GINGER STRONG AND OBSERVED POSSIBLE ALTERNATIVES FOR GROUND WATER PERCOLATION/ RETENTION

1. St. John's River at Cutler Park has deep sand and may offer a possibility of dikes in the river bed for intermittent ground water percolation.

2. Monrovia Nursery (South of Rocky Ford) has 1,600 acres of open space in which some might be useable for retained temporary storage (East of Road 196).

3. Lindsey Strathmore Irrigation District has approximately 1,400 acres of grazing land between the St. John's and Kaweah River. The soil appears to be suitable for percolation and could be bermed up for percolation basins.

4. Hannah Ranch has open space in which Kaweah River Rock wants to open pit mine. John Kirkpatrick and the Kaweah/St. John's Farmers League are fighting the proposed mining operations. This land appears that it would make good percolation basins and is located West of MaKays Point. Some field crops and winter wheat are grown in this area.

5. 220 Acres site s/w of Rocky Ford.

MEETING WITH KAWEAH DELTA WATER CONSERVATION DISTRICT (DISTRICT), JIM CROOK WATER MASTER NOT AVAILABLE. HERB KNIERIM, DISTRICT ENGINEER, MET WITH GINGER STRONG AND MYSELF.

- Flood releases from Terminus Reservoir are generally divided equally into the St. John's and Kaweah Rivers.
- The District recharges the ground water basin with flows from Terminus Reservoir.
- Portions of the basin are currently overdrafted.
- The conservation district is divided into several political divisions.
- Standing water level is currently approximately 110 feet. When the total District basin is full the standing water level is approximately 40 feet.
- The Corcoran Irrigation District is the last point of diversion before the Tulare Lake Bed. The District has all excess water rights and access to 35 different percolation basins (4,000 acre feet per day potential) within Tulare and King's Counties within the Kaweah fan to the Tulare Lake basin.
- The District's high flow rights might be made available to the proposed project operations.
- The District could trade water with other water rights holders to make up the proposed project water. The District has approximately 337,000 acres of service area.

- The US Corps of Engineers have a Terminus Dam reconnaissance study which was completed in 1989 or 1990 which might be helpful.
- Check with Tulare County Planning or the SCS or ASCS for air photographs.
- Tulare County has reproducible maps (1 inch equals 600 foot scale) which may be obtained from Dennis Spears. Cartwright Aviation also should have maps (1 inch equals 2,000 foot scale).
- Terminus Dam is operated by the US Corps of Engineers and generally does not release more than 2,500 cfs unless a certain elevation in the reservoir is reached. Maximum storage capacity is approximately 144,000 acre feet. Minimum pool elevation is generally 5,000 acre feet (but can go to 1,000 acre feet). Below 9,700 acre feet no hydroelectric power is produced. The dam was constructed for flood control and water conservation. Hydroelectrical power is a subsequent use. Recreation is incidental.
- As Visalia takes land out of agricultural production some surface water might become available if the water rights holders were agreeable, currently they are not agreeable to the water staying with the land. If the land is going out of ag production.
- Mill Creek which goes through the City of Visalia will flood with local runoff without letting water into Mill Creek from the Kaweah.
- Long term average releases from Terminus are approximately 400,000 to 500,000 acre feet per year. 1963 through 1984 averaged approximately 500,000 acre feet per year. Minimum releases have been 100,000 acre feet per year and maximum releases have been 1.3 million acre feet per year.
- Surplus water might be available from the Friant for approximately $25 per acre foot. The District Manager is also the water master for all Kaweah and St. John's Rivers water deliveries and all are pre-1914 water rights.
- All water from Terminus is appropriated. The US Corps of Engineers has a study on surplus water to Tulare Lake. Herb Knierim will check if he can release the hydrology for our use.
- The Kaweah Delta Water Conservation District (District) wears three hats.

    1. The Kaweah and St. John's River Association (private) is a result of water rights agreements with some Court judgements. The District Manager serves as a water master for releases.
    2. Kaweah River Power Authority, which 75% is owned by the District and 25% by Tulare Irrigation District (Dave Zack, Secretary).
    3. The District acquires and releases water for ground water recharge.

MEETING WITH BRITT FUSSEL, VISALIA PUBLIC WORKS DIRECTOR [209/738-3321], AND JOHN DUTTON, CITY ENGINEER AND GINGER STRONG

- Britt gave us a draft of the storm water master plan, dated October 1992, by Boyle Engineering for review. This draft is currently being updated and is being developed by the Boyle Fresno office.
- Britt is also checking on an older James Montgomery report, which might be of assistance. A FEMA study was also developed which might be of assistance. Britt and John will check on the availability of this report.
- The City has a goal to obtain an additional 800 + acre feet of flood control storage to reduce flood and storm waters generated by the City.

MEMORANDUM

TO: Minutes to the File

FROM: John W. Brown

CC: G. Strong - City of Visalia
D. Keller -
H. Knierim -
R. Ford - CDM Sacramento
L. McDaniel - CDM WCK
B. Buchholz - CDM WCK

DATE: February 25, 1993

SUBJECT: Site visit and meetings February 22, 1993

Following are notes taken at the above referenced site visit and meeting with Dennis Keller, Herb Knierim and Ginger Strong.

- The City of Visalia would like to consider a sports park in conjunction with flood control retention facilities. The Kaweah Delta Water Conservation District (District) [Herb Knierim] indicated that the District would not be interested in such a joint use of facilities due to the liability and would not take over ownership and operation of a facility in conjunction with a sports park.

- It was noted that any water percolation west of Cutler Park recharges in a northwest direction and would not be of great benefit to Visalia (City).

- It was noted that CDM was not asked to look at any alternatives west of Cutler Park, and due to the City's and CDMs limited budget, this area should not now be included.

- Alternatives near Cutler Park involving levee reconstruction would bring in another political level and may not be desirable at this time. In addition, the Oak Ranch Subdivision Development, north of Cutler Park, is on a sewer leach system. Any recharge in the Cutler Park area could cause major problems with this subdivisions leach fields. Therefore, the Cutler Park alternative should not be considered at this time. The Monrovia Nursery site alternative would probably involve relocating Monrovia Nursery. The nursery probably would not be interested in relocating in that they searched long and hard for disease free soil and a _____ climate

that the Venice Hills provides. In addition, flood control detention from the St. John's river is not the cause of major flooding in the City. For these reasons, it was felt that alternatives on the Kaweah River could best benefit the City. The Giant Oak Ranch alternative was discounted for similar reasons. The MacKay's Point site alternative is owned 1/3 by Tulare Irrigation District, 1/3 by the Visalia-Kaweah group and 1/3 by Consolidated People's Ditch Company. Dennis informed us that they are not interested in dedicating or using this site for flood control, groundwater recharge or environmental habitat purposes.

- The Kaweah River site is owned by the Jacobson family and they are not interested in selling the land.

- SK Ranch owns the Hannah Ranch and may be interested in the City purchasing this property. This site appears to be a good groundwater recharge area, but is located east of Spruce Road. It is believed the major beneficiaries from recharge at this site would be the Exeter's and Farmersville area and not necessarily the City. The owner has an active mining permit and is believed to be the only one in Tulare County. For these reasons, it was suggested that this sight should not be considered as an alternative for the City.

- It was noted that the USBR does not own Friant Canal water.

- LSID property northeast corner site 3 (excluding the farmed area) totals approximately 130 acres. This site could have water converted from the Ketchum Ditch. A berm could be developed around the site to contain water and the site could serve as a possible groundwater recharge, flood control facility and improved environmental habitat area.

- It was noted that the conservation district is charged to maintain the status quo in groundwater elevation, but that the City picks up the responsibility on agricultural lands converted to urban use. It may be the urban developers can participate in off site mitigation to help develop these areas under consideration. The City may be able to develop a depository for mitigation purposes for developers. The conservation district could buy water through developer funding for groundwater recharge and mitigation purposes. Kaweah Oaks site is owned and operated by the Natural Conservancy Agency. The Director's may allow compatible integrated uses and may be receptive to utilizing this site for conservation, flood control and improved environmental habitat. Ginger Strong serves as a Director for the Natural Conservancy Agency.

- Consolidated Ditch site (east side) - 140 acres. This site is 10 to 15 feet lower than the surrounding ground and road elevations. This appears to be an excellent site for groundwater recharge or flood control purposes. The Pergin Ranch is the owner of this site and may be receptive to selling or providing land easements. The land west of the Consolidated Ditch appears to be good soil for groundwater recharge, but is approximately the same grade elevation as Highway 198. Utilization of this site would require berming and more maintenance. It also has some permanent crop plantings in the area while the east side is open land. Either site could receive water from the Consolidated People's Ditch and Deep Creek. It was noted that these soils are highly permeable and is a good place to lose water.

- Stream banks need to be cleaned to percolate water in channels. This might be a good idea in the Consolidated Ditch alternative site.

- Hatchery site - This 90 acre site has been leveled and the field elevation is approximately the same as the surrounding road elevations. All is open ground, but would require pumping to fill. This site would not be very beneficial for flood control purposes but could possibly be used for groundwater percolation.

- It is noted that sites north of 198 and west of Spruce Road would provide the greatest benefit to the City for groundwater percolation and flood control purposes. Alternatives which appear worthy of further consideration include:

  Alternative 1 - Consolidated Ditch site (east side - 140 acres)
  Alternative 2 - St. John's River retarded flow for groundwater percolation (east of Cutler Park up stream)
  Alternative 3 - LSID property northeast corner (excluding the farmed area) - 130 acres
  Alternative 4 - LSID property south of the Kaweah River - 160 acres
  Alternative 5 - LSID property south of the River and east of the railroad tracks - 60 acres

- These sites and alternatives are to receive further investigation in the CDM analysis.

- It was noted that the Monrovia site could be good for recharge, but would not contribute significantly for flood control protection to the City.

- Any alternative west of Cutler park is out of CDMs scope of work.

- Herb Knierim is to provide an estimate of water that could be diverted to the recharge site alternatives in that the City does not have water right entitlement for groundwater percolation.

- CDMs scope consideration/revision:

  1) Don't necessarily let flood control be the driving force of alternatives
  2) Headgate regulation up stream for groundwater percolation will help the City
  3) Stop looking for water for recharge purposes. Reduce or eliminate the hydrology analysis. Herb Knierim will identify water available for groundwater recharge
  4) The alternatives may consider a repository for stormwater and groundwater recharge to offer mitigation for urban developing issues.
  5) CDM to spend the limited budget to identify options and their groundwater percolation and flood control storage capabilities and not to worry about the source or quantity of water.
  6) For each alternative site identify what it has to offer and develop a matrix of advantages and disadvantages, including habitat, groundwater recharge, flood control, estimated value, storage capability, percolation rate, etc.

- The City's runoff water (factor) for the identified and the 20/20 EIR is the water the conservation district may have to work with and to make exchanges for groundwater percolation operations.

- The City (conservation district) could possibly lease tailings of water rights and use checks in the Kaweah River or St. John's River for groundwater percolation, or the City could possibly exchange runoff water with up stream odors.

- The City can berm of dikes in the St. John's in early fall or early spring for groundwater percolation.

- It was noted that the City does have approximately 300 acre feet of CVP Contract water.

JWB:rde
2693.005

MEMORANDUM

TO: Ginger Strong

FROM: John W. Brown

DATE: March 18, 1993
REVISED: April 12, 1993

SUBJECT: Notes on the February 17, 1993 Meeting

Following are notes taken during Site Alternatives Field review with Ginger Strong.

PROPOSED ALTERNATIVES

1 - Consolidated Ditch (Perigan Ranch) - 130 Acres

Consolidate People's Ditch borders the site on the east and Deep Creek on the west. The site is not developed and appears to be 5 to 10 feet lower than the surrounding area. Ponding on this site would require little berming for considerable depth. The soils appear very permeable and suitable for groundwater recharge. Storm flows and percolation water could be diverted into this area from Consolidated Peoples Ditch.

2 - St. Johns River - 40 Acres (of basin storage area)

This site involves berming the river bed up 2 to 3 feet in check dikes for spreading basins in the river bed from Cutter Park east to the Tulare Irrigation Ditch crossing (approximately 2-1/2 miles). The bed would have to be worked up on an annual basis for groundwater recharge. This alternative appears very suitable but costly due to the annual maintenance.

3 - LSID (N.E.) - 230 Acres

Lane Slough water could be diverted into this area. The land elevation is near the same as elevation of Road 196, and the site does not appear it would make a good flood basin area due to lack of ponding depth and potential of flooding Road 196 with a dike failure. The site would be difficult to flood due to the high ground elevation.

4 - LSID (S.W.) - 250 Acres

This site appears to drain from south to north towards the Kaweah River and would require berming of 2 to 3 feet high around the property for containment. The soils appear well drained and compatible to groundwater recharge.

5 - LSID (S.E.) - 80 Acres

This site is between the Consolidated People's Ditch and the railroad tracks. A retention basin could be made by the Consolidated People's Ditch at the Highway (intersection of Lort Drive and Highway 184) and the railroad tracks. The property could be bordered up 3 to 4 feet in order to make a flood basin. The area is now used for cattle grazing.

6 - Kaweah Oaks (West) - 150 Acres

This property and Kaweah Oaks (East) is owned by The Nature Conservancy Agency (TNC) (an international non-profit agency). This agency may work with the City in cooperating and providing land. TNC is interested in preserving the land for long term open space usage. They are currently in the process of turning this land over to a local non-profit corporation, Four Creeks Land Trust. Ginger Strong is on the Board of Directors of 4 Creeks along with

one of the directors from the Kaweah Delta Water Conservation District Board of Directors. 4 Creeks objective is that local values are reflected while providing a broad opportunity management base for the land trust's improvements of wildlife habitat.

7 - Kaweah Oaks (East) - 170 Acres

This site is in the northeast corner crossing Deep Creek. The land is undeveloped and in its natural habitat. It has approximately the same elevation as the road. Part of the site is higher than the road on the southeast border. The land elevation would make it difficult to divert water from Deep Creek. Water would probably be diverted farther up stream in order to flood a bermed up area. The southern border of this site is the Consolidated People's Ditch. The Consolidated People's Ditch could conceivably divert water into this site if it was diverted further up stream and then piped over to the site. The soils look fairly permeable and would be suitable for percolation.

8 - Crocker Environmental Habitat - 5 Acres

This site appears to be fairly high in ground elevation compared with the surrounding housing and roads. Habitat development would be minimal in this area. The cost of developing this site for berming and maintenance would probably prove to be more than other alternatives.

9 - Deep Creek Environmental Habitat Sites - 15 Acres

This site appears to be fairly high in ground elevation compared with the surrounding housing and roads. Habitat development would be minimal in this area. The cost of developing this site for berming and maintenance would probably prove to be more than other alternatives.

10 - Monrovia Reservoir - 190 Acres

The dam site located between the Venice Hills would interfere with a new residence built on the bottom of the channel area, worth approximately $120,000. The distance across to the abutments is approximately 1,500 feet. A dam could conceivably be constructed to an elevation of 20 to 50 feet high. There are approximately 3 acres of walnuts immediately behind the house. The rest of the ground is open and would be a good reservoir site. The flood area could include TIDs ditch or be limited to just inside of the ditch. The ditch bank is about 4 feet high above ground level. The maximum flood plain would be to an elevation of about 2 feet above ground level next to the ditch which would allow for 2 feet of freeboard. Most of the flood plain area is now vacant ground. The area could flood up to Rocky Ford without causing much damage in the flood plain area. The northerly end would be bermed up 2 to 3 feet to save some citrus on the south side of Venice Hills. This alternative could be expensive to Monrovia (i.e. changes in micro climate, possible soil pathogens, problems from H_20, etc.).

11 - LSID (N.W.) - 230 Acres

All LSID sites are owned by the Lindsay-Strathmore Irrigation District. This site is north of the Kaweah River. The ground elevation is approximately the same as Road 196. The soils appear to be tight. Water diversion onto this site for flood control would be difficult. Possibly water could be diverted into Lane Slough from the St. Johns River or Ketchum Ditch.

12 - LSID Site - 120 Acres

This sites ground elevation is approximately the same as Road 196. This property is used for farming. Detention or retention on this site would not be a compatible use. The ground is currently being farmed by the Shannon family in field crops.

13 - Yokohl Creek Environmental Habitat - 80 Acres

There is no way to enter property without trespassing on private roads. No opinions on the site suitability for the time being.

14 - SK Ranch - 300 Acres

This 300 acre site is located south of the Kaweah River. It is currently worked up for pre-irrigation. This site could be used for a detention pond, but would require berming the property all the way around 2 to 3 feet which could conceivably put it higher than Road 212. The soils look a little tight and for these reasons, this may not be a prime site. Also east of Spruce, ground water appears to move south and away from Visalia.

OTHER POSSIBLE ALTERNATIVES

A - Dry Creek Area

Observations up Dry Creek Road to Terminus Dam indicate that the bedrock outcropping in the river bed area is not a very suitable area for groundwater percolation. The river bed soils also look fairly tight and do not appear suitable for conservation practices.

B - Hannah Ranch Site - 775 Acres

The Hannah Ranch site, between the St. Johns and the Kaweah Rivers is currently planted into what looks to be winter wheat. The top soil looks very permeable. Water could be diverted from either river. Methods for groundwater percolation could include:

1. Sprinkler system - with over irrigation
2. Berming for flood irrigation

It may be that the land could be jointly used for crop production and over irrigation for groundwater percolation.

C - McKay's Point - 170 Acres

This site is between the St. Johns and Kaweah Rivers west of McKay's Point and currently is unassessible. The property is owned by the Consolidated People's Ditch Co., Tulare Irrigation District and Visalia-Kaweah Water Company. This group is believed not to be receptive to the area being used as a conservation site.

D - Kaweah River - 180 Acres

This site located south of the Kaweah River in the north half of Block 8. It is also unassessible at this time. The ownership of this property is unknown. Our general feelings are that it is to far east of Spruce Road (Avenue 212) for groundwater recharge. Also due to the proximity of bedrock and tight soils this would not be a good site for alternatives considerations.

E - Hannah Ranch (North) - 775 Acres

This site is north of the Kaweah River and east of Road 212. The same concerns exist on this site as with the SK Ranch site. The land is close in elevation to Road 212 and would require extensive berming all the way around for a flood/recharge basin.

F - Giant Oak Ranch - 320 Acres

This site is all planted into permanent crops and does not appear to be suitable for a dam or reservoir consideration. The other problem with the Giant Oak Ranch site is that it is up stream of the Venice Hills where bedrock is fairly shallow. The north end of the Monrovia Nursery is planted in alfalfa.

G - The Hatchery - 100 Acres

This site is currently open ground that is being farmed. The land elevation is approximately the same as the Road 180. Any utilization of this site would require berming all the way around it and up stream diversion for filling. It does not appear to be one of the better sites.

H - Cutler Park (North) - 40 Acres

This site is on the north side of the St. Johns River near Cutler Park. This area could be bermed up 2 to 3 feet to provide for flood control protection and is currently vacant land. This land is in the flood plain and probably cannot be zoned residential. Water could be diverted into it out of the St. Johns for flood control protection. The soil appears to be highly permeable and suitable for percolation and retention. On the north side of this property, there is a levee to protect the Oak Ranch Housing Development, which could be used to help contain

water. This site appears to be fairly good for flood control and groundwater recharge. Value of this land is probably minimal since it is in the flood plain area. However, a major problem with this site would be with the Oak Ranch sewer septic tanks and leach lines. Raising the groundwater table in this area could cause increased wastewater disposal problems for this neighboring development.

2693.007

cc: Dennis Keller - Keller/Wegley
Herb Knierim - KDWCD
Robert Ford - CDM Sacramento
Lisa McDaniel - CDM Walnut Creek

Appendix C

Part One References

APPENDIX C
References

The following published references were utilized in the preparation of the hydrogeology, soils, and ground water portions of this report:

1. Bookman & Edmonston; February 1972; Report on Investigation of the Water Resources of Kaweah Delta Water Conservation District (Identified water balance for KDWCD, ground water overdraft geology and alternatives to reduce ground water mining).

2. Boyle Engineering Corporation; October 1992; Storm Water Master Plan Draft (Identify alternatives within City to store peak flood flows and determines flood flows, estimates costs and funding.

3. California Department of Water Resources; 1979; Dams Within Jurisdiction of the State of California; Bulletin 17-79.

4. California Department of Water Resources; 1980; Ground Water Basins in California; A Report to the Legislature in Response to Water Code Section 12924; Bulletin 118-80.

5. Croft, M. G. and Gordon, G. V.; 1968; Geology, Hydrology, and Quality of Water in the Hanford-Visalia Area, San Joaquin Valley, California; U. S. Geological Survey; Open-File Report.

6. Davis, G. H. and others; 1957; Ground-Water Conditions and Storage Capacity in the San Joaquin Valley, California; U. S. Geological Survey; Open-File Report.

7. EIP Associates; 1990; Kaweah River Rock Mining and Reclamation Project; Draft Environmental Impact Report.

8. Kaweah Delta Water Conservation District; Weather Modification Program EIR; 1975 (EIR to cloud seed, good information on species, rainfall habitat).

9. KDWCD; 1991-1992; Prelimnary Report 250 wells; SWL 1986 ~ 111.5' decrease of 71.5' in 6 years (Report shows basin quick response).

10. Matthews, R. A. and Burnett, J. L.; 1965; Geologic Map of California: Fresno Sheet; California Division of Mines and Geology.

11. McClelland Consultants; September 1990; Draft EIR Land Use Element Update to Visalia General Plan (Hydrology and flood plain information).

12. Stephens, F. G.; 1982; Soil Survey of Tulare County, California: Central Part; U. S. Department of Agriculture, Soil Conservation Service.

13. U.S. Department of the Interior Geological Survey; April 10, 1968; Geology, Hydrology and Water Quality in the Hanford-Visalia area, San Joaquin Valley, California (Develop data on geology and hydrology of the ground water resources and its settling and describe conditions as they relate to ground water storage and how the study area relates to the valley as a whole).

Appendix D

Calculations for Costs of Facilities

Appendix D By JWB 2-25-93

Calculations for determining storage and water diversion facilities for alternatives 1 THRU 14

Alt & Site 1, Consolidated Ditch - 130 Acres		Cost Est
• Water diversion facilities from Consolidated ditch		# 0
• Berm - 9400' (9' x 3' High) @ #2.00/YD³ or #1.33/Ft		12,500
• Cross Checks & Over Flow Boxes	Est	10,000
• Eng & Misc	Est	10,000
	Total	# 32,500

Alt & Site 2 St Johns River Bed - 40 Ac

• 100' long Cross Berms every 100' up River
= 190 Berms x 100' long = 19,000' Berms
est 3' top, 6' Bottom x 3' High = 240³/Ft
@ #1.00/YD³ = #2/Ft ∴ Annual Cost ~ # 38,000

Alt & Site 3, LSID (N.E.) - 140 Ac		
• Water diversion Facilities from Lone Slough		# 0
• Berms around property ~ 8800' x #1.33/Ft		11,700
• Cross Checks	Est	9,000
• Eng & Misc	Est	10,000
	Total ~	# 30,700

Appendix D (cont'd) 2-25-93 JWB

alt # Site 4; LSID (S.W.) - 250 Ac	cost est
• Water diverted From Consolidated Rogers Ditch (Improvements for Flood control)	10,000
• Berm 18,000'	24,000
• Cross Checks & over flow Boxes	12,000
• Eng & Misc	10,000
TOTAL #	56,000

alt # Site 5, LSID - 80 Ac	
• Water Diverted from Consolidated Rogers Ditch (Improvements for Flood control)	7,000
• Berm 7,000'	9,300
• Cross Checks & overflow Boxes	4,500
• Eng & misc	7,000
TOTAL #	27,800

alt # Site 6; Kaweah Oaks (west) - 150 Ac	
• Water Diverted from Deep Creek & Crocker canal	5,000
• Berm 16000'	21,300
• Cross Checks & Overflow Boxes	11,000
• Eng & Misc	9,000
TOTAL #	46,300

Appendix D (cont) 2-25-93 JWB

alt # Site 7 Kaweah Oaks (East) - 170 Ac

• Water Diverted From Deep Creek & Consolidated Peoples Ditch - Improvements	5,000
• Berm 18,000'	24,000
• Cross Checks	12,000
• Eng & Misc	10,000
TOTAL	$ 51,000

alt # Site 8 Cracker Environmental Habitat - 5 Ac

• Water Diverted from Kaweah River Improvements	5,000
• Berm 3,000' - (2' high - Check Type)	2,000
• Eng & Misc	4,000
TOTAL	$ 11,000

alt # Site 9 Deep Creek Environmental Habitat - 15 Ac

• Water Diverted from Deep Creek Improvements	2000
• Berm 5,000'	6650
• Cross Checks	3,000
• Eng & Misc	4,000
Total	$ 15,650

Appendix D (cont) 2-25-93 JWB

alt # Site 10 Monrovia Reservoir -190 Ac

- Fill Res from St Johns River

20' high Dam 148' Long (8500 YD³)	34,000
SPILLWAY	17,000
Eng & Permits	50,000
EIR	100,000
TOTAL	$201,000

alt # Site 11 LSID (N.W.) - 230 Ac

- Water Diverted From Lane Slough

Improvements	5,000
• Berm 15,000'	20,600
• Cross Checks	10,300
• Eng & Misc.	10,000
Total	$45,900

alt # Site 12 LSID (N. END) - 120 Ac

- Water Diverted From KETCHUM DITCH

Improvements	5000
• Berm 9,200'	12,240
• Cross Checks	6,000
• Eng & Misc	5,000
Total	$28,240

Appendix D (cont) 2-25-93 JWB

alt # Site 13 YOKOHL CREEK - 80 Ac

• Water Diverted From Kaweah River	
Improvements	5,000
• Berm 8600'	11,440
• Cross Checks	6,000
• Eng & Misc	6,000
TOTAL	$ 28,440

alt # Site 14 SK RANCH - 300 Ac

• Water Diverted From the Kaweah River	
Improvements	5,000
• Berm 15,800'	20,500
• Cross Checks	10,000
• Eng & Misc	7,000
TOTAL	$ 37,500

Appendix E

Calculations for Part One Tables 4-1, 4-2, 4-3, and 4-4 (Alternatives Ranking)

Appendix E BY JWB 3-24-93

Calculations for determining alternatives Ranking for Tables 4.1, 4.2, 4.3 and 4.4

Table 4.1 Analysis 4% INTEREST - 15 YR AMORTIZATION

(A)	(B)	(C)	(D)	(E)	(F)
	RECHARGE, F.C. & ENVIR VALUE	STORAGE COST/A.F	COST RANKING	TOTAL PT. VALUE	RANKING
1	9	$69	1	126	1
2	5	475	14	5	14
3	8	197	7	64	7
4	8	160	5	80	4
5	8	140	4	88	3
6	7	204	8	49	8
7	7	134	2	91	2
8	5	329	13	10	13
9	5	247	12	15	12
10	6	137	3	72	5
11	7	195	6	63	6
12	7	246	11	28	11
13	7	257	10	35	10
14	7	234	9	42	9

(B) = 3 Pts FOR RECHARGE, LOW = 1, MED = 2, HIGH = 3 & SAME FOR FLOOD CONTROL & ENVIR. HABITAT OR MAX. of 9 Pts

(C) = STORAGE COST FROM CALCULATIONS IN APPENDIX D

(E) = TOTAL Pt. VALUE = (B) × (15-D) ; (15-D) ~ INVERSE OF COST RANKING

Appendix E (cont) by JWB 3-24-93

TABLE 4.2 Analysis, 4% interest 30 year amortization on land and 15 years on facilities

(A)	(B)	(C)	(D)	(E)	(F)
	ENVIR	STORAGE	COST	TOTAL PT.	
ALT.	VALUE	COST/A.F.	RANKING	VALUE	RANKING
1	9	$46	1	126	1
2	5	475	14	5	14
3	8	132	7	64	6
4	8	107	5	80	4
5	8	98	3	96	2
6	7	140	8	49	8
7	7	92	2	91	3
8	5	265	13	10	13
9	5	183	12	15	12
10	6	99	4	66	5
11	7	131	6	63	7
12	7	166	10	35	10
13	7	176	11	28	11
14	7	154	9	42	9

Appendix E (cont'd) By JWB 3-24-93

Table 4.3 Analysis 6% interest, 15 year Amortization

(A)	(B)	(C)	(D)	(E)	(F)
ALT	ENVIR VALUE	STORAGE COST/A.F	COST RANKING	TOTAL PT. VALUE	RANKING
1	9	$ 79	1	126	1
2	5	475	14	5	14
3	8	224	7	64	6
4	8	183	5	72	4
5	8	160	4	88	3
6	7	231	8	49	9
7	7	153	2	91	2
8	5	369	13	10	13
9	5	279	10	25	11
10	6	156	3	72	5
11	7	223	6	63	7
12	7	280	11	28	10
13	7	291	12	21	12
14	7	267	9	63	8

appendix E (cont) By JWB 3-24-93

Table 4.4 Analysis - 6% interest, 30 year amortization on Land, 15 years on facilities

ALT	ENVIR VALUE	STORAGE COST/A.F.	COST RANKING	TOTAL PT. VALUE	RANKING
1	9	$ 57	1	126	1
2	5	475	14	5	14
3	8	164	7	56	6
4	8	133	5	80	4
5	8	119	3	96	2
6	7	171	8	49	8
7	7	113	2	91	3
8	5	308	13	10	13
9	5	219	12	15	12
10	6	119	4	60	5
11	7	162	6	56	7
12	7	204	10	35	10
13	7	216	11	28	11
14	7	191	9	42	9

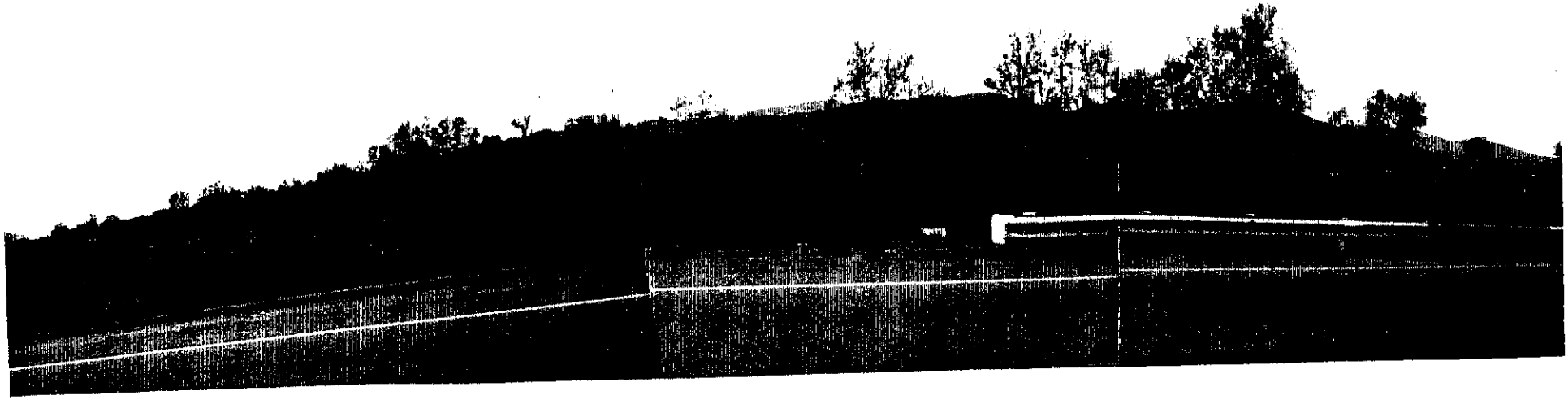
Appendix F

Photographs of Part One Alternatives

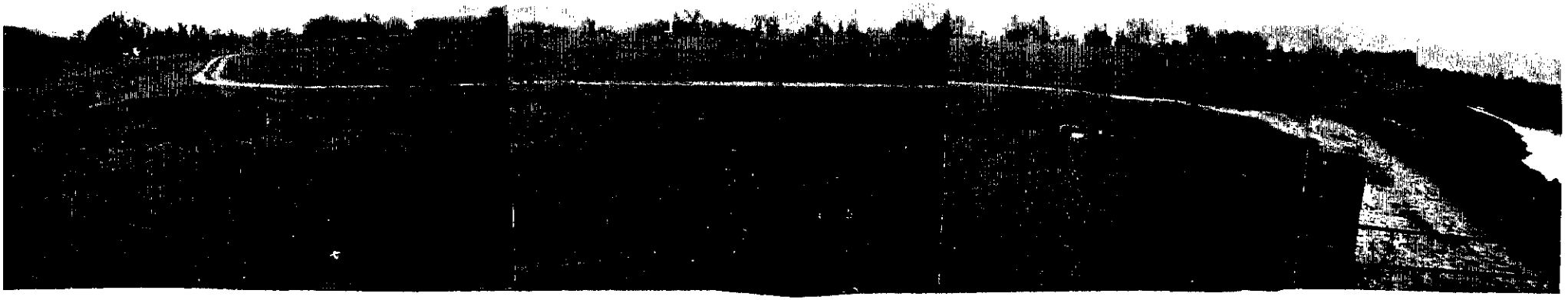
KAWEAH DELTA

Alternative 2 • St. John's River (Upstream at Cutler Park)

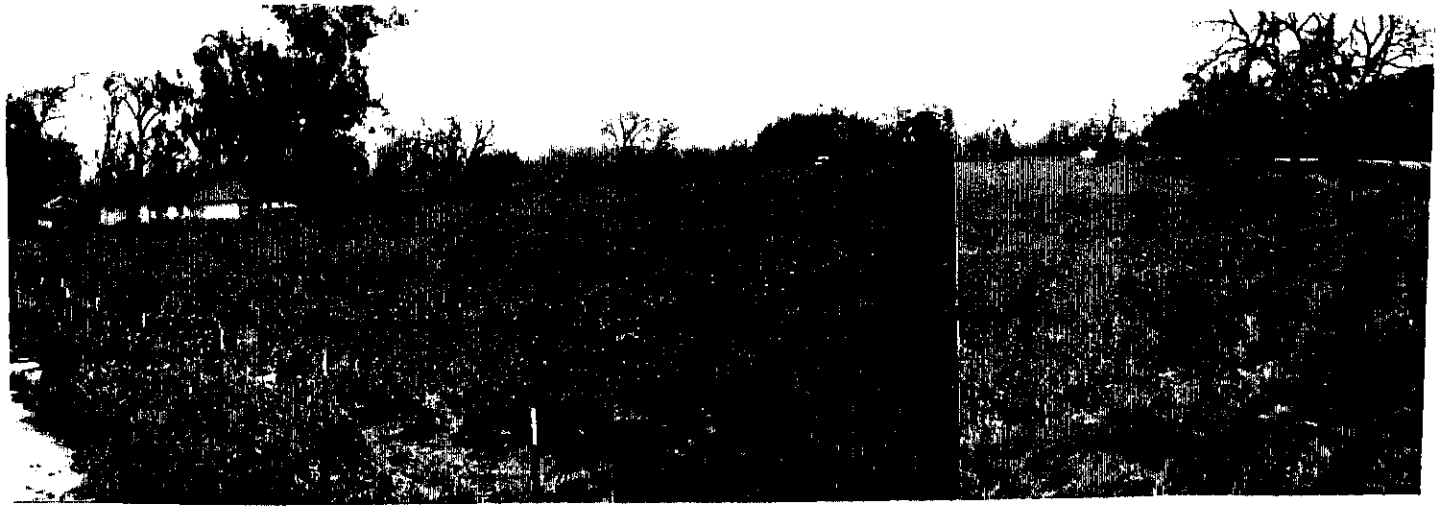
Alternative 2 • St. John's River (Downstream at Cutler Park)



Alternative 4 • LSID (S.W.)

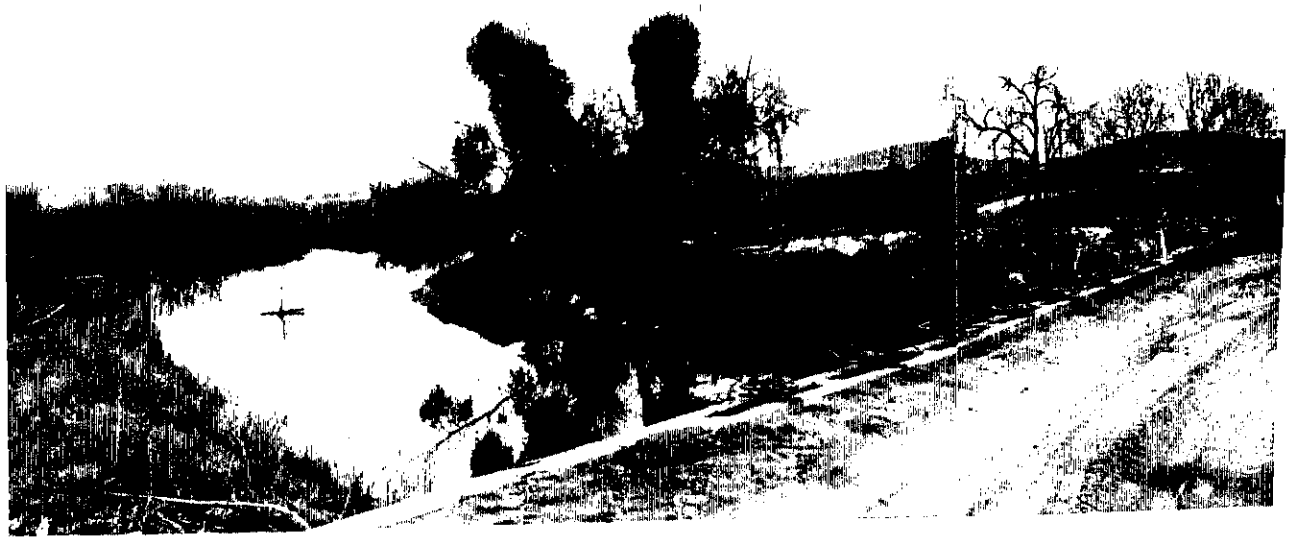


Alternative 5 • LSID (S.E.)



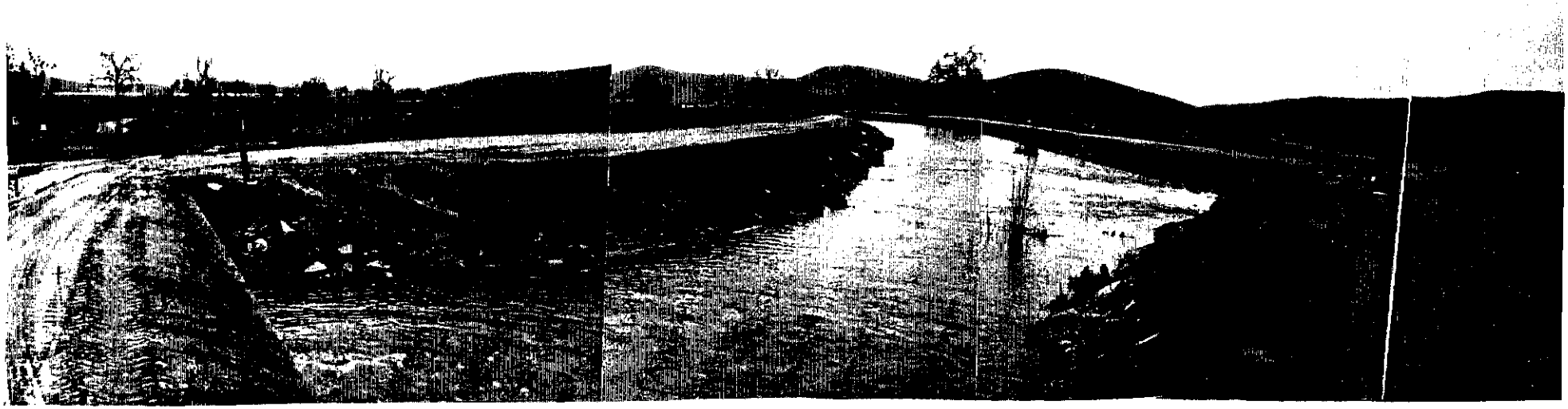
Alternative 8 • Crocker Environmental Habitat

Alternative 10 • Monrovia Reservoir (East Embankment)



Alternative 10 • Monrovia Reservoir (Rockey Ford looking SE)

Alternative 10 • Monrovia Reservoir (West Embankment)



Alternative 10 • Monrovia Reservoir (Rockey Ford looking SW - TID Canal)

Alternative 11 • LSID (N.W.)

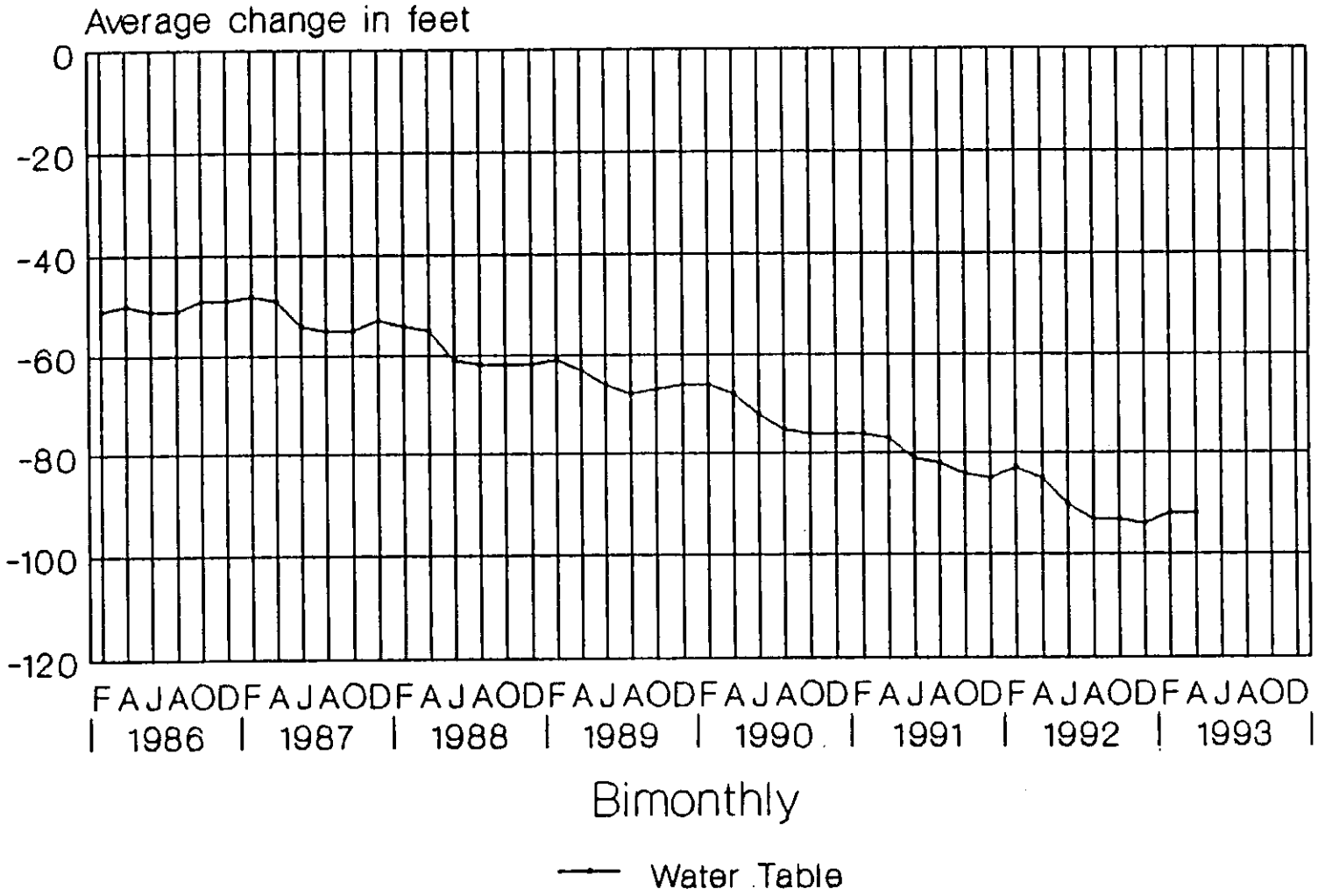
St. John's River
(looking West at Road 196)

Appendix G

Groundwater Levels - California Water Service Company

GROUNDWATER LEVELS

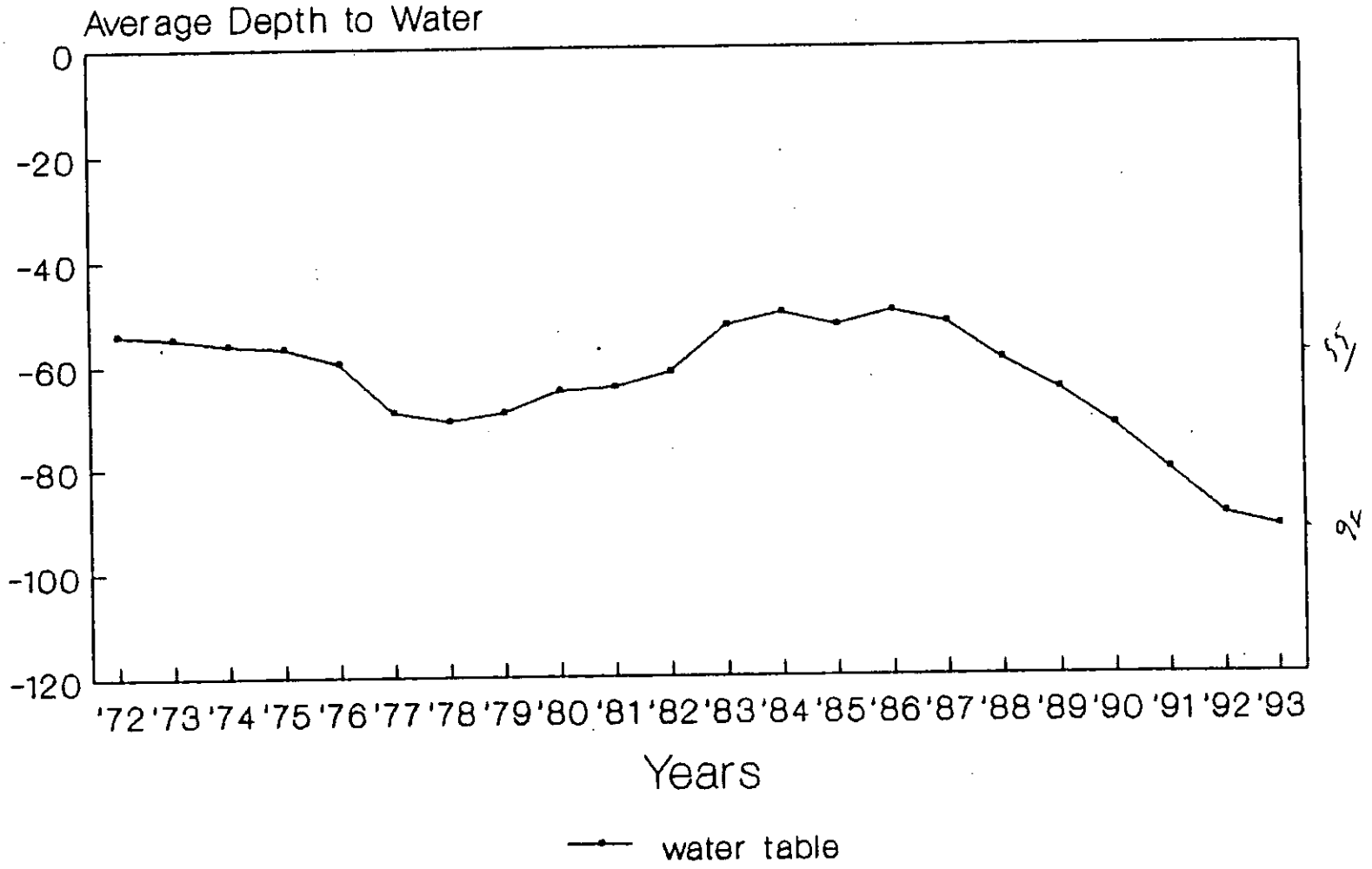
(surface to water)



KDWCD - Visalia groundwater measurements

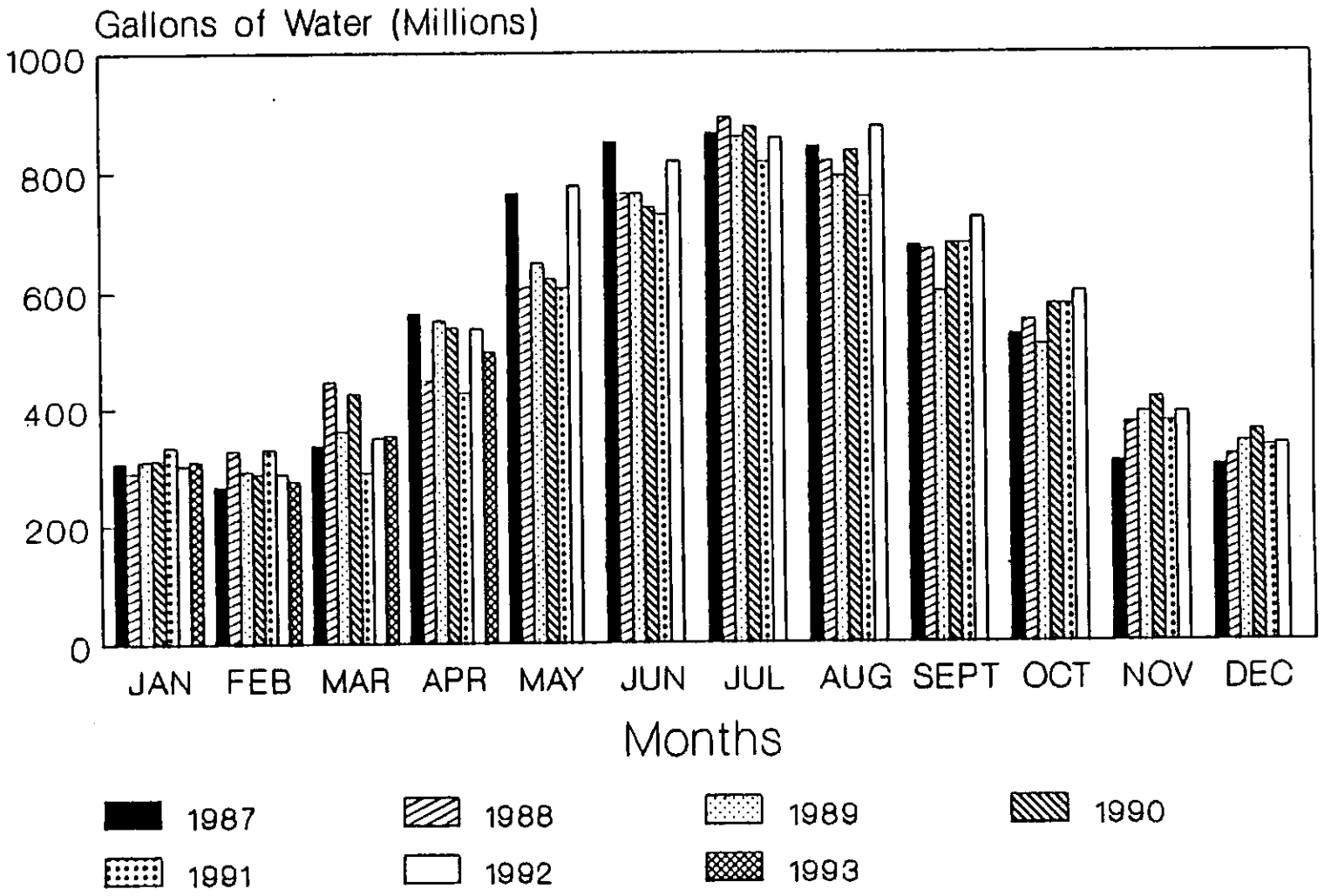
REF. CALIF WATER SERVICE COMPANY (BOUNDRY)

AVERAGE GROUNDWATER LEVELS
(measured in feet)



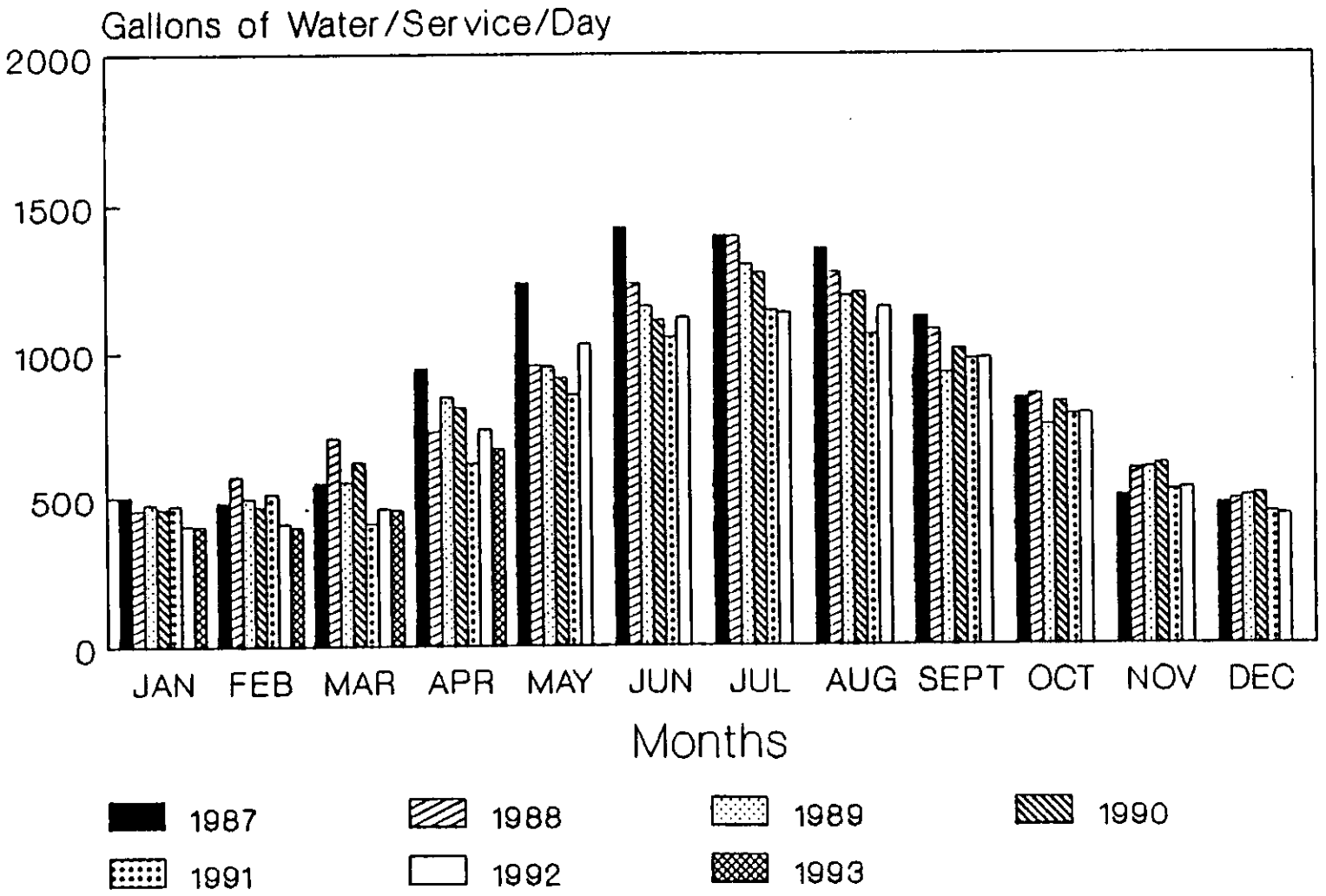
TOTAL WATER PRODUCTION

(Historical Data)



AVERAGE WATER USAGE

(Gallons Per Service Per Day)



Appendix H

Descriptions of Natural Communities of the Kaweah River Corridor

The following descriptions of the nine natural plant communities found within the Study Area are based on Holland's Preliminary Descriptions of the Terrestrial Natural Communities of California (1986). Most of the regional biological surveys conducted in the southern San Joaquin Valley follow the plant community classification system developed by Holland. Element Codes follow the numbering system used by California Natural Diversity Data Base (CNDDB).

ELEMENT NAME: Great Valley Valley Oak Riparian Forest — ELEMENT CODE: 61430

DESCRIPTION: A medium to tall (rarely to 100 feet) broadleaved, winter deciduous, closed-canopy riparian forest dominated by *Quercus lobata.* Understories include scattered *Fraxinus latifolia, Juglans hindsii,* and *Platanus racemosa* as well as young *Q. lobata.* Lianas often are conspicuous, quickly occupying wind-throw generated light gaps. They also are more scattered throughout the shady understory.

SITE FACTORS: Restricted to the highest parts of floodplains, most distant from or higher above active river channels and therefore less subject to physical disturbance from flooding, but still receiving annual inputs of silty alluvium and subsurface irrigation. Intergrades closer to the river with Great Valley Mixed Riparian Forest (61420).

CHARACTERISTIC SPECIES: *Aristolochia californica, Clematis ligusticifolia, Elymus triticoides, Fraxinus latifolia, Juglans hindsii, Platanus racemosa, Quercus lobata, Rosa californica, Rubus* spp., *Smilax californica, Toxicodendron diversilobum*

DISTRIBUTION: Formerly extensive on low-gradient, depositional reaches of the major streams of the Sacramento and northern San Joaquin valleys. More scattered in the San Joaquin watershed and on the floodplains of the Kings and Lower Kaweah rivers. Now virtually eliminated by agriculture and fire wood harvesting.

ELEMENT NAME: Great Valley Mixed Riparian Forest — ELEMENT CODE: 61420

DESCRIPTION: This is a tall, dense, winter-deciduous, broadleaved riparian forest. The tree canopy usually is fairly well closed and moderately to densely stocked with several species including *Acer negundo californica, Juglans hindsii, Platanus racemosa, Populus fremontii, Salix gooddingii variabilis, S. laevigata,* and *S. lasiandra.* Understories consist of these taxa plus shade-tolerant shrubs like *Cephalanthus occidentalis* and *Fraxinus latifolia.* Several lianas are conspicuous

in both tree and shrub canopies.

SITE FACTORS: Relatively fine-textured alluvium somewhat back from active river channels. These sites experience overbank flooding (with abundant alluvial deposition and groundwater recharge) but not too severe physical battering or erosion. Intergrades closer to the river with Great Valley Cottonwood Riparian Forest (61410) where disturbance is both more frequent and more severe; intergrades farther away from the river with Great Valley Valley Oak Riparian Forest 61430) where such disturbance is less.

CHARACTERISTIC SPECIES: *Acer negundo californica, Cephalanthus occidentalis, Clematis ligusticifolia, Juglans hindsii, Platanus racemosa, Populus fremontii, Salix gooddingii variabilis, S. laevigata, S. lasiandra, Toxicodendron diversilobum, Vitis californica*

DISTRIBUTION: Floodplains of low-gradient, depositional streams of the Great Valley, usually below about 500 feet. Formerly very extensive in the Sacramento and northern San Joaquin Valleys, this forest largely has been cleared for agriculture, flood control and urban expansion.

ELEMENT NAME: Great Valley Willow Scrub ELEMENT CODE: 63410

DESCRIPTION: An open to dense, broadleafed, winter-deciduous shrubby streamside thicket dominated by any of several *Salix* species. Dense stands usually have little understory or herbaceous component. More open stands have grassy understories, usually dominated by introduced species.

SITE FACTORS: Not discussed.

CHARACTERISTIC SPECIES: *Bromus diandrus, Chenopodium ambrosioides, Cynodon dactylon, Populus fremontii, Rosa californica, Salix hindsiana, S. lasiandra, S. lasiolepis, S. melanopsis, Vitis californica*

DISTRIBUTION: All along the major rivers and most of the smaller streams throughout the Great Valley watershed, usually below 1000 feet.

ELEMENT NAME: Elderberry Savanna ELEMENT CODE: 63430

DESCRIPTION: An open, winter-deciduous shrub savanna dominated by *Sambucus mexicana*, usually with an understory of introduced annual grasses and forbs. This seral community rapidly succeeds to Great Valley Mixed Riparian

Forest (61420) without grazing, flooding, or fire. Such "old" stands frequently are overrun by *Vitis californica.*

SITE FACTORS: Deep, fine-textured, rich alluvium well back from active river channels, but still subject to flooding (and therefore input of silt) during high water.

CHARACTERISTIC SPECIES: *Bromus diandrus, B. mollis, Centaurea solstitialis, Marrubium vulgare, Sambucus mexicana*

DISTRIBUTION: Spottily scattered among surviving stands of riparian vegetation throughout the Sacramento and northern San Joaquin Valleys, at least as far south as Merced County.

ELEMENT NAME: Valley Oak Woodland ELEMENT CODE: 71130

DESCRIPTION: Similar to Northern Oak Woodland (71110) and Blue Oak Woodland (71140), but typically more open, forming a grassy-understoried savanna rather than a closed woodland. *Quercus lobata* is usually the only tree present. This winter-deciduous species is California's largest broad-leaved tree, with mature individuals reaching 15-35 m. Most stands consist of open-canopy growth from trees and seldom exceed 30-40% absolute cover.

SITE FACTORS: On deep, well-drained alluvial soils, usually in valley bottoms, apparently with more moisture in summer than in Blue Oak Woodland (71140). Intergrades with Valley Oak Riparian Forest (62143) near rivers and with Blue Oak Woodland (71140) on drier slopes. Also found on nonalluvial settings in the South Coast and Transverse ranges. Fire may have prevented some valley oak stands from succeeding to Ponderosa Pine (84130, 84210) or Coulter Pine (84140) forests before fire suppression.

CHARACTERISTIC SPECIES: *Quercus lobata, Elymus triticoides, Toxicodendron diversilobum, Q. Douglasii.*

DISTRIBUTION: Sacramento and San Joaquin valleys adjacent to the Sierra Nevada foothills; valleys of the Coast Ranges from Lake County to western Los Angeles County. Usually below 2000 ft (610 m).

ELEMENT NAME: Non-native Grassland ELEMENT CODE: 42200

DESCRIPTION: A dense to sparse cover of annual grasses with flowering culms 0.2-0.5 (1.0) m high. Often associated with numerous species of showy-flowered, native annual forbs ("wildflowers"), especially in years of favorable rainfall. Germination occurs with the onset of the late fall rains; growth, flowering, and seed-set occur from winter through spring. With a few exceptions, the plants are dead through the summer-fall dry season, persisting as seeds.

SITE FACTORS: On fine-textured, usually clay soils, moist or even waterlogged during the winter rainy season and very dry during the summer and fall. Oak Woodland (71100) is often adjacent on moister, better drained soils.

CHARACTERISTIC SPECIES: *Avena barbata, A. fatua, Bromus mollis, B. rigidus, B. rubens, Erodium botrys, E. circutarium, Eschsholtzia californica, Gilia spp., Hemizonia spp., Lasthenia spp., Layia spp., Lolium multiflorum, Lupinus spp., Lepidium dictyotum, Medicago hispida, Nemophila mennziesii, Orthocarpus spp., Phacelia spp., Schismus arabicua, Vulpia megalura, V. microstachys*

DISTRIBUTION: Valleys and foothills of most of California, except for the north coastal and desert regions. Usually below 3000 ft., but reaching 4000 ft. in the Tehachapi Mtns. and interior San Diego Co. Intergrades with coastal prairie (41000) along the central coast. Formerly occupied large portions of the Sacramento, San Joaquin, and Salinas Valleys as well as the Los Angeles Basin, areas that are now agricultural or urban.

ELEMENT NAME: Valley Sacaton Grassland ELEMENT CODE: 42120

DESCRIPTION: Midheight (to 3 feet) tussock-forming grassland dominated by *Sporobolus airoides*.

SITE FACTORS: Fine-textured, poorly drained, usually alkaline soils. Most sites have seasonally high water tables or are overflowed during winter flooding. Intergrades and often co-occurs with Alkali Meadow (45310) and Northern Claypan Vernal Pool (44120).

CHARACTERISTIC SPECIES: *Distichlis spicata, Hordeum depressum, Sporobolus airoides*, others?

DISTRIBUTION: Formerly extensive in the Tulare Lake Basin and along the San Joaquin Valley trough north to Stanislaus and Contra Costa Counties, now much reduced.

ELEMENT NAME: Alkali Meadow ELEMENT CODE: 45310

DESCRIPTION: Dense to fairly open growth of perennial grasses and sedges. Usually low growing, but occassionally with tufts to 1 m high (*Sporobolus airoides*). Growing and flowering season from late spring to early fall. Relatively few species.

SITE FACTORS: On fine-textured, more or less permanently moist, alkaline soils. May intergrade with Great Basin Sagebrush (35200), Shadscale Scrub (34400, 35400), or Great Basin Grassland (43100) on moist, non-alkaline soil; with Desert Chenopod Scrub (36100) on drier, more alkaline soils; with Non-native Grassland (42200), Valley Sacaton Grassland (42120), and Northern Claypan Vernal Pools (44120) on drier, less alkaline soils of the Central Valley; or with Alkali Marsh (52300) on permanently flooded sites.

CHARACTERISTIC SPECIES: *Allenrolfea occidentalis, Anemopsis californica, Carex* spp., *Cordylanthus mollis hispidus, Distichlis spicata* var. *stricta, Juncus* spp., *Muhlenbergia asperifolia, Phragmites australis, Sida hederacea, Sisyrinchium halophyllum, Spartina gracilis, Sporobolus airoides, Triglochin concinna debilis*

DISTRIBUTION: In valley bottoms and on the lower portions of alluvial slopes east of the Cascades and Sierra Nevada, from Modoc Plateau to Owens Valley at elevations of 3500 to 7000 ft. (1070 to 2130m). Also occurring around alkali Seeps (45320) arising from the Valley Springs Formation of eastern Central Valley from Kern to Placer Counties, on salt-affected grasslands of the San Joaquin Valley trough and the Livermore Valley, and the salty grasslands of the western Sacramento Valley from San Joaquin to Glenn and Colusa Counties.

ELEMENT NAME: Valley Wildrye Grassland ELEMENT CODE: 42140

DESCRIPTION: A dense sod prairie dominated by *Elymus triticoides*.

SITE FACTORS: Moist sites at low elevations, often adjacent to stands of riparian forest or freshwater marsh. Soils frequently subalkaline and/or seasonally overflowed.

CHARACTERISTIC SPECIES: *Artemisia douglasiana, Elymus triticoides, Urtica holosericea*, others?

DISTRIBUTION: Scattered widely through the Central Valley and surrounding foothills.

ELEMENT NAME: Northern Hardpan Vernal Pool ELEMENT CODE: 44110

DESCRIPTION: A low, amphibious, herbaceous community dominated by annual herbs and grasses. Germination and growth begin with winter rains, often continuing even when inundated. Rising spring temperatures evaporate the pools, leaving concentric bands of vegetation that colorfully encircle the drying pool.

SITE FACTORS: Old, very acidic, iron-silica cemented hardpan soils (Redding, San Joaquin, and similar series). The microrelief on these soils typically is hummocky, with mounds intervening between localized depressions. Winter rainfall perches on the hardpan, forming pools in the depressions. Evaporation (not runoff) empties the pools in spring.

CHARACTERISTIC SPECIES: *Allocarya stipitata micrantha, A. undulata, Boisduvalia stricta, Deschampsia danthonoides, Downingia bicornuta, D. cuspidata, D. pulchella, Eryngium vasseyi, Juncus leiospermus, J. uncialis, Lasthenia fremontii, Limnanthes alba, Limosella aquatica, Navarretia leucocephala, Orthocarpus campestris, Pogogyne zizyphoroides, Psilocarphus brevissimus, Veronica arvensis*

DISTRIBUTION: "Red Dirt Hogwallow Lands", primarily on old alluvial terraces on the east side of the Great Valley from Tulare or Fresno County north to Shasta County.

Appendix I

Plant Species of the Kaweah River Corridor

Family	Scientific Name	Common Name(s)	Status*
AMARANTHACEAE	Amaranth Family		
	Amaranthus albus	Tumble Pigweed	I
	Amaranthus blitoides	Prostrate Pigweed	
	Amaranthus hybridus	Green Amaranth	I
	Amaranthus retroflexus	Redroot Pigweed	I
ANACARDIACEAE	Sumac Family		
	Rhus diversiloba	Poison Oak	
APOCYNACEAE	Dogbane Family		
	Apocynum cannabinum	Indian Hemp	
ASCLEPIADACEAE	Milkweed Family		
	Asclepias fascicularis	Narrow-leaved Milkweed	
ASTERACEAE	Sunflower Family		
	Ambrosia acanthicarpa	Annual Bur-weed or Sand-Bur	
	Ambrosia psilostachya	Western Ragweed	
	Anaphalis margaritacea	Pearly Everlasting	
	Artemisia douglasiana	California Mugwort or Wormwood	
	Aster exilis	Slender Aster	
	Baccharis glutinosa	Mule Fat	
	Baccharis viminea	Mule Fat	
	Bidens frondosa	Beggar-Ticks or Stick-Tight	
	Centaurea solstitialis	Yellow Star Thistle	I
	Cirsium vulgare	Bull Thistle	I
	Conyza bonariensis	Flax-leaved Fleabane	I
	Conyza canadensis	Horseweed	
	Eclipta alba	False Daisy	
	Gnaphalium palustre	Lowland Cudweed	
	Grindelia procera	Tall Gumweed	
	Helianthus annuus var. lenticularis	Common Sunflower	
	Hemizonia pungens	Common Spikeweed or Tarweed	
	Heterotheca grandiflora	Telegraph Weed	
	Hypochoeris glabra	Cat's Ear	I
	Lactuca serriola	Prickly Lettuce	I
	Senecio douglasii	Bush Groundsel	
	Senecio vulgaris	Common Groundsel	I
	Silybum marianum	Milk Thistle	I
	Solidago occidentalis	Western Goldenrod	
	Sonchus asper	Spiny Sow Thistle	I
	Sonchus oleraceous	Common Sow Thistle	
	Stephanomeria exigua	Twiggy Wreath Plant	
	Xanthium spinosum	Spint Clotbur	I
	Xanthium strumarium	Cocklebur	I

Family	Scientific Name	Common Name(s)	Status*
BETULACEAE	Birch Family		
	Alnus rhombifolia	White Alder	
BORAGINACEAE	Borage Family		
	Amsinckia intermedia	Common Fiddleneck	
	Amsinckia menziesii	Rigid fiddleneck	
	Heliotropium curvassavicum	Alkali Heliotrope	
CAPRIFOLIACEAE	Honeysuckle Family		
	Sambucus mexicana	Southwestern or Desert Elderberry	
CARYOPHYLLACEAE	Pink Family		
	Spergularia atrosperma	Sticky Sand-Spurry	
	Spergularia macrotheca var. leucantha		
	Stellaria media	Common Chickweed	I
CHENOPODIACEAE	Goosefoot Family		
	Bassia hyssopifolia	Five-Hook Bassia	I
	Chenopodium album	Pigweed or Lamb's-Quarters	I
	Chenopodium ambrosioides	Mexican-Tea	I
	Nitrophila occidentalis	Nitrophila	
CONVOLVULACEAE	Morning-Glory Family		
	Convolvulus arvensis	Field Bindweed	I
	Ipomoea nil	Ivyleaf Morning-Glory	I
CRASSULACEAE	Stonecrop Family		
	Tillaea erecta	Pygmy Stonecrop	
CRUCIFERAE	Mustard Family		
	Brassica geniculata	Shortpod Mustard	I
	Brassica nigra	Black Mustard	I
	Capsella bursa-pastoris	Shepherd's Purse	I
	Lepidium dictyotum	Peppergrass	
	Raphanus sativus	Wild Radish	I
	Rorippa curvisiliqua	Western Yellow Cress	
	Sisymbrium irio	London Rocket	I
	Sisymbrium officinale	Hedge Mustard	I
CUCURBITACEAE	Gourd Family		
	Citrullus lanatus var. citroides	Citron	I
	Cucurbita foetidissima	Stinking Gourd	
	Cucurbita palmata	Coyote Gourd or Coyote Melon	

Family Scientific Name	Common Name(s)	Status*
CUSCUTACEAE Dodder Family		
Cuscuta sp	Dodder	
CYPERACEAE Sedge Family		
Carex barbarae	Santa Barbara Sedge	
Cyperus alternifolius ?	Umbrella-Plant	I ?
Eleocharis macrostachya	Common or Creeping Spikerush	
Scirpus acutus	Common Tule	
EQUISETACEAE Horsetail Family		
Equisetum laevigatum	Braun's Scouring-Rush	
EUPHORBIACEAE Spurge Family		
Eremocarpus setigerus	Doveweed	
Ricinus communis	Castor Bean	I
FAGACEAE Beech Family		
Quercus lobata	Valley Oak	
Quercus wislizenii	Interior Live Oak	
FRANKENIACEAE Heath Family		
Frankenia grandifolia var. campestris	Alkali Heath	
GERANIACEAE Geranium Family		
Erodium botrys	Long-beaked Filaree	I
Erodium cicutarium	Redstem Filaree	I
Erodium moshatum	Whitestem Filaree	I
Geranium carolinianum	Carolina Geranium	
HALORAGACEAE Water-Milfoil Family		
Myriophyllum spicatum ssp. exalbescens	Water-Milfoil	
HIPPOCASTANACEAE Buckeye Family		
Aesculus californica	Buckeye or Horse Chestnut	
HYDROPHYLLACEAE Waterleaf Family		
Eriodictyon californicum	Yerba Santa	
JUGLANDACEAE Walnut Family		
Juglans regia	English Walnut	I

Family	Scientific Name	Common Name(s)	Status*
JUNCACEAE	Rush Family		
	Juncus balticus	Baltic Rush	
LABIATAE	Mint Family		
	Marrubium vulgare	Horehound	I
	Stachys albens	White or Whitestem Hedge Nettle	
LEGUMINOSAE	Pea Family		
	Cercis occidentails	Western Redbud	
	Glycyrrhiza lepidota var. glutinosa	Wild Licorice	
	Lupinus albifrons	Bush Lupine	
	Lupinus bicolor	Miniature Lupine	
	Lotus purshianus	Spanish Clover	I
	Medicago polymorpha	Bur-Clover	I
	Medicago sativa	Alfalfa	I
	Melilotus albus	White Sweet-Clover	I
	Melilotus indicus	Yellow Sweet-Clover	I
	Psoralea macrostachya	Leather Root	
	Robinia pseudo-acacia	Black Locust	I
	Trifolium repens	White Lawn Clover	I
	Trifolium tridentatum	Tomcat Clover	
	Vicia villosa	Winter Vetch	I
LEMNACEAE	Duckweed Family		
	Lemna minor	Lesser Duckweed	
LORANTHACEAE	Mistletoe Family		
	Phoradendron tomentosum ssp. macrophyllum	Greenleaf Mistletoe	
LYTHRACEAE	Loosestrife Family		
	Ammania coccinea	Red-Stem or Long-leaved Ammania	
MALVACEAE	Mallow Family		
	Malva parviflora	Cheeseweed	I
MARSILEACEAE	Pepperwort or Marsilea Family		
	Marsilea vestita	Clover Fern or Hairy Pepperwort	
MORACEAE	Mulberry Family		
	Maclura pomifera	Osage Orange	I
	Ficus carica	Fig	I
MYRTACEAE	Myrtle Family		
	Eucalyptus globulus	Blue Gum	I

Family Scientific Name	Common Name(s)	Status*
OLEACEAE Olive Family		
Fraxinus latifolia	Oregon Ash or Swamp Ash	
ONAGRACEAE Evening-Primrose Family		
Epilobium adenocaulon	Northern Willow-Herb	
Epilobium paniculatum	Panicled Willow-Herb or Parched Fireweed	
Epilobium watsonii	Watson's Fireweed	
Ludwigia peploides	Marsh Primrose or Yellow Water Weed	
PLATANACEAE Sycamore Family		
Platanus racemosa	Western Sycamore	
POACEAE Grass Family		
Arundo donax	Giant Reed	I
Avena barbata	Slender Oat	I
Avena fatua	Wild Oat	I
Briza minor	Little Quakinggrass	I
Bromus diandrus	Ripgut Brome	I
Bromus mollis	Soft Chess	I
Bromus rubens	Red Brome or Foxtail Brome	I
Cynodon dactylon	Bermudagrass	I
Dactylis glomerata	Orchard Grass	I
Digitaria ischaemum	Smooth Crabgrass	I
Digitaria sanguinalis	Large or Hairy Crabgrass	I
Distichlis spicata	Saltgrass	
Echinochloa colonum	Jungle Rice	I
Echinochloa crusgalli	Barnyardgrass	I
Elymus triticoides	Creeping Wildrye or Alkali Rye	
Eragrostis diffusa	Spreading Lovegrass	
Eragrostis orcuttiana	Orcutt Lovegrass	
Eriochloa gracilis	Southwestern Cupgrass	
Hordeum geniculatum	Mediterranean Barley	I
Hordeum leporinum	Hare Barley	I
Leersia oryzoides	Rice Cutgrass	
Leptochloa fascicularis	Bearded or Loose-flowered Sprangletop	
Leptochloa uninerva	Mexican or Dense-flowered Sprangletop	
Lolium multiflorum	Italian or Australian Ryegrass	I
Muhlenbergia rigens	Deergrass	
Paspalum dilitatum	Dallisgrass	I
Polypogon monspeliensis	Rabbitsfootgrass	I
Sorghum halapense	Johnsongrass	I
Sporobolus airoides	Alkali Sacaton Bunchgrass	
Vulpia megalura	Foxtail Fescue	
Vulpia myuros	Rattail Fescue	I
POLYGONACEAE Buckwheat Family		
Polygonum argyrocoleon	Silversheath Knotweed	I
Polygonum lapathifolium	Pale Smartweed or Willow-Weed	
Rumex crispus	Curly Dock or Yellow Dock	I

Family Scientific Name	Common Name(s)	Status*
PORTULACACEAE Purslane Family		
Calandrinia ciliata	Red Maids	I
POTAMOGETONACEAE Pondweed Family		
Potamogeton foliosus	Leafy Pondweed	
RANUNCULACEAE Crowfoot Family		
Clematis ligusticifolia	Western Virgin's Bower	
Ranunculus californicus	California Buttercup	
ROSACEAE Rose Family		
Rosa californica	California Wild Rose	
Rubus procerus	Himalaya-Berry	I
Rubus ursinus	California Blackberry	
RUBIACEAE Madder Family		
Cephalanthus occidentalis var. californicus	Buttonbush or Buttonwillow	
SALICACEAE Willow Family		
Populus fremontii	Fremont Cottonwood	
Salix gooddingii	Valley Willow or Black Willow	
Salix hindsiana	Sandbar Willow	
Salix laevigata	Red Willow or Polished Willow	
Salix lasiolepis	Arroyo Willow	
SALVINIACEAE Salvinia Family		
Azolla filiculoides	Water Fern or Duckweed	
SAURURACEAE Lizard Tail Family		
Anemopsis californica	Yerba mansa or Coneflower	
SAXIFRAGACEAE Saxifrage Family		
Ribes quercetorum	Oak Gooseberry	
SCROPHULARIACEAE Figwort Family		
Mimulus guttatus	Seep-spring Monkey Flower	
Verbascum thapsus	Common or Woolly Mullein	I
Veronica sp	Speedwell	
SIMARUBACEAE Quassia Family		
Ailanthus altissima	Tree of Heaven	I

Family	Scientific Name	Common Name(s)	Status*
SOLANACEAE	Nightshade Family		
	Datura meteloides	Tolguacha	
	Datura stramonium	Jimson Weed	
	Nicotiana bigelovii	Indian Tobacco	
	Nicotiana glauca	Tree Tobacco	I
	Solanum elaeagnifolium	Silverleaf Nightshade	I
	Solanum nigrum	Black Nightshade	I
TYPHACEAE	Cat-Tail Family		
	Typha domingensis	Narrow-leaved Cat-Tail	
	Typha latifolia	Broadleaf Cat-Tail	
UMBELLIFERAE	Carrot Family		
	Conium maculatum	Poison Hemlock	I
URTICACEAE	Nettle Family		
	Urtica holosericea	Stinging Nettle	
	Urtica urens	Dwarf Nettle	I
VITACEAE	Grape Family		
	Parthenocissus quinquefolia	Virginia Creeper	I
	Vitis californica	California Wild Grape	
	Vitis vinifera	Cultivated Grape	I
ZYGOPHYLLACEAE	Caltrop Family		
	Tribulus terrestris	Puncture Vine or Caltrop	I

Status Code:
I = Introduced (Non-Native) Plant

Appendix J

Birds of the Kaweah River Corridor

Family	Scientific name	Common Name	Status*
PODICIPEDIDAE	Grebes		
	Podilymbus podiceps	Pied-billed Grebe	O, Y, N
	Podiceps nigricollis	Eared Grebe	R, W
	Aechmophorus occidentalis	Western Grebe	R, Y
	Aechmophorus clarkii	Clark's Grebe	R, Y
PELECANIDAE	Pelicans		
	Pelecanus erythrorhynchos	American White Pelican	R, W
PHALACROCORACIDAE	Cormorants		
	Phalacrocorax auritus	Double-crested Cormorant	R, W
ARDEIDAE	Herons and Egrets		
	Botaurus lentiginosus	American Bittern	R, W
	Ardea herodias	Great Blue Heron	O, Y, N
	Casmerodius albus	Great Egret	O, Y, N
	Egretta thula	Snowy Egret	R, W
	Bubulcus ibis	Cattle Egret	R, W
	Butorides striatus	Green-backed Heron	O, Y, N
	Nycticorax nycticorax	Black-crowned Night Heron	R, Y
ANATIDAE	Ducks, Swans and Geese		
	Chen caerulescens	Snow Goose	R, W
	Branta canadensis	Canada Goose	R, W
	Aix sponsa	Wood Duck	O, Y, N
	Anas crecca	Green-winged Teal	R, W
	Anas platyrhynchos	Mallard	O, Y, N
	Anas acuta	Northern Pintail	R, W
	Anas discors	Blue-winged Teal	R, T
	Anas cyanoptera	Cinnamon Teal	R, Y
	Anas clypeata	Northern Shoveler	R, W
	Anas strepera	Gadwall	R, Y
	Anas americana	American Wigeon	R, W
	Aythya valisineria	Canvasback	R, W
	Aythya collaris	Ring-necked Duck	R, W
	Aythya fuligula	Tufted Duck	R, W
	Aythya affinis	Lesser Scaup	R, W
	Bucephala clangula	Common Goldeneye	R
	Bucephala albeoa	Bufflehead	R, W
	Lophodytes cucullatus	Hooded Merganser	R, W
	Mergus merganser	Common Merganser	O, Y
	Oxyura jamaicensis	Ruddy Duck	R, Y, N
CATHARTIDAE	American Vultures		
	Cathartes aura	Turkey Vulture	O, S

Family	Scientific name	Common Name	Status*
ACCIPITRIDAE	Kites, Eagles, and Hawks		
	Pandion haliaetus	Osprey	R, T
	Elanus caeruleus	Black-shouldered Kite	R, Y, N
	Haliaeetus leucocephalus	Bald Eagle	R, W
	Circus cyaenus	Northern Harrier	R, W
	Accipiter striatus	Sharp-shinned Hawk	R, W
	Accipiter cooperii	Cooper's Hawk	R, Y, N
	Buteo lineatus	Red-shouldered Hawk	O, Y, N
	Buteo jamaicensis	Red-tailed Hawk	O, Y, N
	Buteo regalis	Ferruginous Hawk	R, W
	Buteo lagopus	Rough-legged Hawk	R, W
	Aquila chrysaetos	Golden Eagle	R, Y, N
FALCONIDAE	Falcons		
	Falco sparverius	American Kestrel	O, Y, N
	Falco columbarius	Merlin	R, W
	Falco mexicanus	Prairie Falcon	R, W
PHASIANIDAE	Quail and Pheasants		
	Phasianus colchicus	Ring-necked Pheasant	R, Y, N
	Callipepla californica	California Quail	O, Y, N
RALLIDAE	Rails, Gallinules and Coots		
	Rallus limicola	Virginia Rail	R, W
	Porzana carolina	Sora	R, W
	Gallinula chloropus	Common Moorhen	R, W
	Fulica americana	American Coot	O, Y, N
CHARADRIIDAE	Plovers		
	Charadrius vociferus	Killdeer	O, Y, N
RECURVIROSTIDAE	Stilts and Avocets		
	Himantopus mexicanus	Black-necked Stilt	O, S
SCOLOPACIDAE	Sandpipers		
	Tringa melanoleuca	Greater Yellowlegs	R, W
	Actitis macularia	Spotted Sandpiper	O, Y
	Numenius phaeopus	Whimbrel	R, T
	Numenius americanus	Long-billed Curlew	R, W
	Calidris mauri	Western Sandpiper	R, T
	Calidris minutilla	Least Sandpiper	R, W
	Calidris alpina	Dunlin	R, W
	Limnodromus scolopaceus	Long-billed Dowitcher	R, W
	Gallinago gallinago	Common Snipe	R, W

Family	Scientific name	Common Name	Status*
LARIDAE	Gulls and Terns		
	Larus philadelphia	Bonaparte's Gull	R, W
	Larus delawarensis	Ring-billed Gull	R, W
	Larus californicus	California Gull	R, W
	Sterna caspia	Caspian Tern	R, S
COLUMBIDAE	Pigeons and Doves		
	Columba livia	Rock Dove	O, Y, N
	Columba fasciata	Band-tailed Pigeon	R, W
	Zenaida macroura	Mourning Dove	O, Y, N
CUCULIDAE	Cuckoos and Roadrunners		
	Geococcyx californianus	Greater Roadrunner	O, Y
TYTONIDAE	Barn Owls		
	Tyto alba	Barn Owl	O, Y, N
STRIGIDAE	Typical Owls		
	Otus kennicottii	Western Screech-Owl	R, Y
	Bubo virginianus	Great Horned Owl	O, Y, N
APODIDAE	Swifts		
	Chaetura pelagica	Black Swift	O, S
	Chaetura vauxi	Vaux's Swift	R, T
	Aeronautes saxatalis	White-throated Swift	R, Y
TROCHILIDAE	Hummingbirds		
	Archilocus alexandri	Black-chinned Hummingbird	O, S, N
	Calypte anna	Anna's Hummingbird	O, Y, N
	Selasphorus rufus	Rufous Hummingbird	R, T
ALCEDINIDAE	Kingfishers		
	Ceryle alcyon	Belted Kingfisher	O, Y, N
PICIDAE	Woodpeckers		
	Melanerpes lewis	Lewis's Woodpecker	R, W
	Melanerpes formicivorus	Acorn Woodpecker	O, Y, N
	Sphyrapicus ruber	Red-breasted Sapsucker	R, W
	Picoides nuttallii	Nuttall's Woodpecker	O, Y, N
	Picoides pubescens	Downy Woodpecker	O, Y, N
	Picoides villosus	Hairy Woodpecker	R, W
	Colaptes auratus	Northern Flicker	O, Y, N

Family	Scientific name	Common Name	Status*
TYRANNIDAE	Tyrant Flycatchers		
	Contopus borealis	Olive-sided Flycatcher	O,T
	Contopus sordidulus	Western Wood-Pewee	O, S, N
	Empidonax traillii	Willow Flycatcher	O,T
	Empidonax difficilis	Pacific-slope Flycatcher	R, T
	Sayornis nigricans	Black Phoebe	O, Y, N
	Sayornis saya	Say's Phoebe	R, W
	Myiarchus cinerascens	Ash-Throated Flycatcher	O, S, N
	Tyrannus verticalis	Western Kingbird	O, S, N
	Tyrannus tyrannus	Eastern Kingbird	R, V
ALAUDIDAE	Larks		
	Eremophila alpestris	Horned Lark	R, W
HIRUNDINIDAE	Swallows		
	Tachycineta bicolor	Tree Swallow	O, S, N
	Tachycineta thalassina	Violet-green Swallow	O, S
	Stelgidopteryx serripennis	Northern Rough-winged Swallow	O, S, N
	Hirundo pyrrhonota	Cliff Swallow	O, S, N
	Hirundo rustica	Barn Swallow	O, S, N
CORVIDAE	Ravens, Jays and Crows		
	Aphelocoma coerulescens	Scrub Jay	O, Y, N
	Corvus brachyrhynchos	American Crow	O, Y, N
	Corvus corax	Common Raven	O, Y, N
PARIDAE	Titmice		
	Parus inornatus	Plain Titmouse	O, Y, N
AEGITHALIDAE	Bushtit		
	Psaltriparus minimus	Bushtit	O, Y, N
SITTIDAE	Nuthatches		
	Sitta carolinensis	White-breasted Nuthatch	R, Y
CERTHIIDAE	Creepers		
	Certhia americana	Brown Creeper	R, W
TROGLODYTIDAE	Wrens		
	Salpinctes obsoletus	Rock Wren	R, Y
	Thryomanes bewickii	Bewick's Wren	O, Y, N
	Troglodytes aedon	House Wren	O, Y, N
	Cistothorus palustris	Marsh Wren	R, Y

Family	Scientific name	Common Name	Status*
CINCLIDAE	Dippers		
	Cinclus mexicanus	American Dipper	R, W
MUSCICAPIDAE	Kinglets, Gnatcatchers, and Thrushes		
	Regulus calendula	Ruby-crowned Kinglet	R, W
	Polioptila caerulea	Blue-gray Gnatcatcher	R, W
	Sialia mexicana	Western Bluebird	O, Y, N
	Sialia currucoides	Mountain Bluebird	R, W
	Catharus ustulatus	Swainson's Thrush	R, T
	Catharus guttatus	Hermit Thrush	R, W
	Turdus migratorius	American Robin	O, Y, N
	Ixoreus naevius	Varied Thrush	R, W
MIMIDAE	Mockingbirds and Thrashers		
	Mimus polyglottos	Northern Mockingbird	O, Y, N
MOTACILLIDAE	Pipits		
	Anthus rubescens	American Pipit	R, W
BOMBYCILLIDAE	Waxwings		
	Bombycilla cedrorum	Cedar Waxwing	R, W
PTILOGONATIDAE	Silky-Flycatchers		
	Phainopepla nitens	Phainopepla	R, W
LANIIDAE	Shrikes		
	Lanius ludovicianus	Loggerhead Shrike	O, Y, N
STURNIDAE	Starlings		
	Sturnus vulgaris	European Starling	O, Y, N
VIREONIDAE	Vireos		
	Vireo solitarius	Solitary Vireo	R, T
	Vireo huttoni	Hutton's Vireo	R, W
	Vireo gilvus	Warbling Vireo	R, T
EMBERIZIDAE	Wood Warblers, Tanagers, Sparrows, and Blackbirds		
	Vermivora celata	Orange-crowned Warbler	R, W
	Vermivora ruficapilla	Nashville Warbler	R, T
	Dendroica petechia	Yellow Warbler	O, S
	Dendroica coronata	Yellow-rumped Warbler	R, W
	Dendroica nigrescens	Black-throated Gray Warbler	R, T
	Dendroica townsendi	Townsend's Warbler	R, T

Family	Scientific name	Common Name	Status*
EMBERIZIDAE	Wood Warblers, Tanagers, Sparrows, and Blackbirds (cont.)		
	Dendroica occidentalis	Hermit Warbler	R, T
	Oporornis tolmiei	MacGillivray's Warbler	R, T
	Geothlypis trichas	Common Yellowthroat	O, Y, N
	Icteria virens	Yellow-breasted Chat	R, S, N
	Piranga ludoviciana	Western Tanager	R, T
	Pheucticus ludovicianus	Rose-breasted Grosbeak	R, V
	Pheucticus melanocephalus	Black-headed Grosbeak	O, S, N
	Guiraca caerulea	Blue Grosbeak	O, S, N
	Passerina amoena	Lazuli Bunting	O, S, N
	Pipilo chlorurus	Green-tailed Towhee	R, W
	Pipilo erythrophthalmus	Rufous-sided Towhee	O, Y, N
	Pipilo crissalis	California Towhee	O, Y, N
	Chondestes grammacus	Lark Sparrow	R, Y
	Passerculus sandwichensis	Savannah Sparrow	R, W
	Passerella iliaca	Fox Sparrow	R, W
	Melospiza melodia	Song Sparrow	O, Y, N
	Melospiza lincolnii	Lincoln's Sparrow	R, W
	Zonotrichia albicollis	White-throated Sparrow	R, W
	Zonotrichia atricapilla	Golden-crowned Sparrow	R, W
	Zonotrichia leucophrys	White-crowned Sparrow	R, W
	Junco hyemalis	Dark-eyed Junco	R, W
	Agelaius phoeniceus	Red-winged Blackbird	O, Y, N
	Agelaius tricolor	Tricolored Blackbird	O, Y
	Sturnella neglecta	Western Meadowlark	O, Y, N
	Euphagus cyanocephalus	Brewer's Blackbird	O, Y, N
	Molothrus ater	Brown-headed Cowbird	O, Y, N
	Icterus galbula	Northern Oriole	O, S, N
FRINGILLIDAE	Finches		
	Carpodacus purpureus	Purple Finch	R, W
	Carpodacus mexicanus	House Finch	O, Y, N
	Carduelis pinus	Pine Siskin	R, W
	Carduelis psaltria	Lesser Goldfinch	R, W
	Carduelis lawrencei	Lawrence's Goldfinch	R, W
	Carduelis tristis	American Goldfinch	O, Y
PASSERIDAE	Weavers		
	Passer domesticus	House Sparrow	O, Y, N

*Status Codes:

O = observed during 1993 field survey
R = recorded within the study area (last 8 years)
S = summer visitor to study area
W = winter visitor to study area
Y = year round resident within the study area
N = nests within the study area
T = transient - commonly migrates through the study area
V = vagrant - outside of species normal range

Appendix K

Mammals of the Kaweah River Corridor

Family	Scientific Name	Common Name	Status*
Class: MAMMALIA			
Order: MARSUPIALIA Opossums, Kangaroos, and Relatives			
Family: DIDELPHIDA Opossums			
	Didelphis virginiana	Virginia Opossum	O
Order: INSECTIVORA Shrews and Moles			
Family: SORICIDAE Shrews			
	Sorex ornatus	Ornate Shrew	T
Family: TALPIDAE Moles			
	Scapanus latimanus	Broad-footed Mole	O
Order: CHIROPTERA Bats			
Family: VESPERTILIONIDAE Vespertilionid Bats			
	Myotis lucifugus	Little Browm Myotis	T
	Myotis yumanensis	Yuma Myotis	T
	Myotis evotis	Long-eared Myotis	T
	Myotis thysanodes	Fringed Myotis	T
	Myotis volans	Long-legged Myotis	T
	Myotis californicus	California Myotis	T
	Myotis leibu	Small-footed Myotis	T
	Lasionveteris noctivagans	Silver-haired Bat	T
	Pipistrellus hesperus	Western Pipistrelle	T
	Eptesicus fuscus	Big Brown Bat	T
	Lasiurus borealis	Red Bat	T
	Lasiurus cinereus	Hoary Bat	T
	Euderma maculatum	Spotted Bat	T
	Plecotcus townsendii	Townsend's Big-eared Bat	T
	Antrozous pallidus	Pallid Bat	T
Family: MOLOSSIDAE Free-tailed Bats			
	Tadarida brasiliensis	Brazilian Free-tailed Bat	T
	Eumops perotis	Western Mastiff Bat	T
Order: LAGOMORPHA Rabbits, Hares, and Pikas			
Family: LEPORIDAE Rabbits and Hares			
	Sylvilagus bachmani	Brush Rabbit	T
	Sylvilagus audubonii	Desert Cottontail	O
	Lepus californicus	Black-tailed Hare	O
Order: RODENTIA Squirrels, Rats, Mice, and Relatives			
Family: SCIURIDAE Squirrels, Chipmunks, and Marmots			
	Spermophilus beecheyi	California Ground Squirrel	O

Family	Scientific Name	Common Name	Status*
Family: GEOMYIDAE Pocket Gophers			
	Thomomys bottae	Botta's Pocket Gopher	O
Family: HETEROMYIDAE Pocket Mice and Kangaroo Rats			
	Perognathus inornatus	San Joaquin Pocket Mouse	T
	Perognathus californicus	California Pocket Mouse	T
	Dipodomys heermanii	Heerman's Kangaroo Rat	T
Family: CASTORIDAE Beavers			
	Castor canadensis	Beaver	T
Family: CRICETIDAE Deer Mice, Voles, and Relatives			
	Reithrodontomys megalotis	Western Harvest Mouse	O
	Peromyscus californicus	California Mouse	T
	Peromyscus maniculatus	Deer Mouse	T
	Peromyscus boylii	Brush Mouse	T
	Onychomys torridus	Southern Grasshopper Mouse	T
	Neotoma fuscipes	Dusky-footed Woodrat	T
	Microtus californicus	California Vole	O
	Ondatra zibethicus	Muskrat	R
Family: MURIDAE Old World Rats and Mice			
	Rattus rattus	Black Rat	R
	Rattus norvegicus	Norway Rat	T
	Mus musculus	House Mouse	R
Order: CARNIVORA Carnivores			
Family: CANIDAE Foxes, Wolves, and Relatives			
	Canis latrans	Coyote	R
	Vulpes vulpes	Red Fox	T
	Vulpes macrotis mutica	San Joaquin Kit Fox	R
	Urocyon cineroargenieus	Gray Fox	O
Family: URSIDAE Bears			
	Ursus americanus	Black Bear	R
Family: PROCYONIDAE Raccoons and Relatives			
	Bassariscus astutus	Ringtail	R
	Procyon lotor	Raccoon	O
Family: MUSTELIDAE Weasels, Badgers, and Realtives			
	Mustela frenata	Long-tailed Weasel	O
	Mustela vison	Mink	R
	Taxidea taxus	Badger	T

Family	Scientific Name	Common Name	Status*
Family: MUSTELIDAE Weasels, Badgers, and Realtives (cont.)			
	Spilogale gracilis	Western Spotted Skunk	T
	Mephitis mephitis	Striped Skunk	O
	Lutra canadensis	River Otter	R
Family: FELIDAE Cats			
	Felis concolor	Mountain Lion	R
	Lynx rufus	Bobcat	R
Order: ARTIODACTYLA Pigs, Deer, and Relatives			
Family: CERVIDAE Deer, Elk, and Relatives			
	Odocodeus hemionus	Mule Deer	O

*Status Code:
O = observed during the 1993 field surveys
R = recorded within the study area
T = recorded in Tulare County*

*source: Calif. Dept. of Fish and Game Wildlife Habitat Relationship System Database Version April 8, 1988.

Appendix L

Reptiles and Amphibians of the Kaweah River Corridor

Scientific Name	Common Name	Status
Class: AMPHIBIA		
Order: CAUDATA		
Family: PLETHODONTIDAE Lungless Salamanders		
Batrachoseps pacificus	Pacific Slender Salamander	
Batrrachoseps nigriventris	Black-bellied Slender Salamander	
Order: SALIENTIA Frogs and Toads		
Family: PELOBATIDAE Spadefoot Toads		
Scaphiopus hammondi	Western Spadefoot Toad	R
Family: BUFONIDAE True Toads		
Bufo boreas	Western Toad	O
Family: HYLIDAE Treefrogs and Relatives		
Hyla regilla	Pacific Treefrog	O
Family: RANIDAE True Frogs		
Rana catesbeiana	Bullfrog	O
Class: REPTILIA		
Order: TESTUDINES Turtles		
Family: EMYDIDAE Pond and Marsh Turtles		
Clemmys marmorata	Western Pond Turtle	O
Order: SQUAMATA Lizards and Snakes		
Family: IGUANIDAE Iguanids		
Sceloporus occidentalis	Western Fence Lizard	O
Uta stansburiana	Side-blotched Lizard	R
Family: SCINCIDAE Skinks		
Eumeces gilberti	Gilbert's Skink	R
Family: TEIIDAE Whiptails		
Cnemidophorus tigris	Western Whiptail	O
Family: ANGUIDAE Alligator Lizards		
Gerrhonotus multicarinatus	Southern Alligator Lizard	R

Scientific Name	Common Name	Status
Family: ANNIELLIDAE California Legless Lizards		
Anniella pulchra	California Legless Lizard	R
Family: COLUBRIDAE Colubrids		
Coluber constrictor	Racer	R
Masticophus taeniatus	Striped (California) Whipsnake	O
Pituophis melanoleucus	Gopher Snake	R
Lampropeltis getulus	Common Kingsnake	R
Thamnopsis elegans	Western Terrestrial Garter Snake	
Thamnophis sirtalis	Common Garter Snake	O
Thamnophis couchi	Western Aquatic Garter Snake	
Family: VIPERIDAE Vipers		
Crotalus viridis	Western Rattlesnake	R

Status codes:

O = Observed during the 1993 Field Surveys
R = Recorded within the Study Area
All others are presumed to be present within the study area.

Appendix M

Fish of the Kaweah River Corridor

Family	Scientific Name	Common Name	Status*
CYPRINIDAE	Minnow Family		
	Ptychocheilus grandis	Sacramento Squawfish	N
	Cyprinus carpio	Carp	I
	Hesperoleucus symmetricus	California Roach	N
	Mylopharodon conocephalus	Hardhead	N
	Notemigonus crysoleucas	Golden Shiner	I
CATOSTOMIDAE	Sucker Family		
	Catastomus occidentalis	Sacramento Sucker	N
CENTRARCHIDAE	Sunfish Family		
	Lepomis microlophus	Redear Sunfish	I
	Lepomis macrochirus	Bluegill	I
	Lepomis cyanellus	Green Sunfish	I
	Micropterus punctatus	Spotted Bass	I
	Micropteris salmoides	Largemouth Bass	I
	Pomoxis nigromaculatus	Black Crappie	I
CLUPEIDAE	HerringFamily		
	Dorosoma petenense	Threadfin Shad	I
ICTALURIDAE	Catfish Family		
	Ictalurus catus	White Catfish	I
	Ictalurus neblosus	Brown Bullhead	I
PETROMYZONTIDAE	Lamprey Family		
	Lampetra hubbsi	Kern Brook Lamprey	N
POECILIIDAE	Livebearer Family		
		Mosquitofish	I

*Status Codes:

N = Native Fish Species
I = Introduced (Non-native) Fish Species

Appendix N

Access Correspondence

TULARE IRRIGATION DISTRICT

P. O. BOX 1920
1350 WEST SAN JOAQUIN AVENUE
TULARE, CALIFORNIA 93275
PHONE (209) 686-3425

July 22, 1993

Mrs. Ginger Strong, Arborist
City of Visalia
707 West Acequia
Visalia, Ca. 93291

Dear Ginger:

This is to confirm, as you have already been instructed, that access to the McKay Point Property owned by the Tulare Irrigation District is denied for any purpose. The property is not to be entered by your agency without specific approval of all the owners. This includes all three parcels located North and South of the diversion structure and the parcel located between the divide West of the structure.

We would expect the city to respect our wishes and not jeopardize the agreements between the District and City that were arduously hammered out over the past five years.

Thank you for your consideration

Gerald C. Hill, Jr.,
General Manager

VISALIA & KAWEAH WATER COMPANY
P.O. BOX 366
FARMERSVILLE, CA 93223
594-4589
747-1177

JULY 20, 19993

Ginger Strong
City of Visalia

RE: Kaweah River Corridor Study

Dear Ms. Strong,

Please be advised that Visalia & Kaweah Water Company, being a one-third owner in the Mckay's Point property, is denying permission to access our property for the Kaweah River Corridor Study.

If you require further information please feel free to contact our office.

Sincerely,

Chris Tantau, Mgr.

CONSOLIDATED PEOPLES DITCH COMPANY
P.O. BOX 366
FARMERSVILLE, CA 93223
594-4589
747-1177

JULY 20, 1993

Ginger Strong
City Of Visalia

RE: Kaweah River Corridor Study

Dear Ms. Strong,

Consolidated Peoples Ditch Company (C.P.D.C.) owns an one-third interest in the Mckay's Point property. It is our understanding that the Kaweah River Corridor study is interested in including McKay's Point within this study.

This letter is to inform you that C.P.D.C. is denying access to the Mckay's Point property for the purpose of this corridor study. Please contact us if you need additional information.

Sincerely,

Chris Tantau

Appendix O

CEQA Review

Appendix O

CEQA REVIEW

The Kaweah River Delta Corridor Enhancement Study requires no CEQA review because feasibility studies are considered under the category of statutory exemptions. A statutory exemption is one that the State legislature has determined should be exempt from CEQA. Section 15262 of the Act cites that feasibility studies involving future actions which a jurisdiction has not approved, adopted or funded do not require an environmental impact report or a negative declaration. However, these types of studies shall consider environmental factors.

The Notice of Exemption and a discussion of environmental considerations follow.

Notice of Exemption

City of Visalia
Environmental Document # 93-27

To: ☐ Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814

☒ County Clerk
County of Tulare
County Civic Center
Visalia CA 93291

From: (Public Agency) City of Visalia
707 W Acequia Street
(Address)
Visalia CA 93291

Project Title: Kaweah River Delta Corridor Enhancement Study

Project Location - Specific: The Kaweah River Delta bounded by Terminus Dam to the east, St Johns River on the north, the Kaweah River to the south and the City of Visalia urban area boundry on the west.

Project Location - City: none **Project Location - County:** Tulare

Description of Project: Feasibility level study to determine if the potential exists for intregration of water resouce manangement and native plant and animal habitat restoration.

Name of Public Agency Approving Project: City of Visalia

Name of Person or Agency Carrying Out Project: Ginger Strong

Exempt Status: (*check one*)

- ☐ Ministerial (Sec. 21080(b)(1); 15268);
- ☐ Declared Emergency (Sec. 21080(b)(3); 15269(a));
- ☐ Emergency Project (Sec. 21080(b)(4); 15269(b)(c));
- ☐ Categorical Exemption. State type and section number:
- ☒ Statutory Exemptions. State code number: CEQA Guidelines section 15262 Public Resouces Code Sections 21102 and 21150

Reasons why project is exempt: The study involves only the feasibility for possible future action.

Lead Agency Contact Person: Ginger Strong Area Code/Telephone/Extension: (209) 738-3522.

If filed by applicant:

1. Attach certified document of exemption finding.
2. Has a Notice of Exemption been filed by the public agency approving the project? ☐ Yes ☐ No

Signature: Ginger Strong Date: 7-29-93 Title: Environmental Coordinator

☒ Signed by Lead Agency

☐ Signed by Applicant

Date received for filing at OPR:

Revised October 19

ENVIRONMENTAL CONSIDERATIONS*

	POTENTIAL ENVIRONMENTAL IMPACTS		
	YES	MAYBE	NO
1. EARTH	X		
2. AIR	X		
3. WATER	X		
4. PLANT LIFE	X		
5. ANIMAL LIFE		X	
6. NOISE		X	
7. LIGHT AND GLARE			X
8. LAND USE			X
9. NATURAL RESOURCES	X		
10. RISK OF UPSET			X
11. POPULATION			X
12. HOUSING			X
13. TRANSPORTATION/CIRCULATION	X		
14. PUBLIC SERVICES		X	
15. ENERGY			X
16. UTILITIES		X	
17. HUMAN HEALTH			X
18. AESTHETICS		X	
19. RECREATION		X	
20. CULTURAL RESOURCES		X	

The study is exempt from CEQA (see Statutory Exemption Section 15262), however, consideration of environmental factors is required.

See following for explaination of checklist answers.

EXPLANATION OF CHECKLIST ANSWERS

Would the development of any of the candidate sites in the feasibility study impact the following?:

1. **Earth.** **Yes**

   Minor grading and compaction of soils could occur on candidate sites. This work could expose soils to wind and water erosion.

2. **Air.** **Yes**

   If any of the candidate sites were to be developed, increased air emissions could occur. Short term impacts could be generated from construction vehicles and dust particulate from grading activities. Long term impacts could occur if passive recreational opportunities were incorporated into candidate sites. Vehicle emissions could be generated by trips to the recreational facilities. A long term benefit could be derived if candidate sites are revegetated.

3. **Water.** **Yes**

   Surface water could be diverted into candidate sites for flood control, storm water detention, groundwater recharge and native plant and animal habitat enhancement. No water quantity or quality changes would be anticipated.

4. **Plant Life.** **Yes**

   Restoration of the Valley Oak Riparian forest could occur around candidate sites. Restoration work could increase the numbers of native species found in this plant community which is considered by the State of California as a sensitive habitat.

5. **Animal Life.** **Maybe**

   This feasibility study will not create any significant adverse environmental impact to the State and Federally recognized species listed in Part Two, Section 3.3.5. Numbers of animal species could increase if habitat quality improves through restoration around candidate sites.

6. **Noise.** **Maybe**

   All of the candidate sites are in rural areas surrounded by agricultural properties. If passive recreation facilities are integrated into any candidate sites, increased noise levels could result.

7. **Light and Glare.** **No**

   No new light or glare would be produced which would significantly impact agricultural areas.

8. **Land Use.** **No**

The candidate sites are all native, non-cultivated lands used for grazing or agricultural purposes. Development of a candidate site should not conflict with adjacent, existing land uses.

9. **Natural Resources.** **Yes**

Development of any candidate site would result in an increase in the rate of natural resources associated with construction activities.

10. **Risk of Upset.** **No**

Candidate sites development would not produce a risk of explosion or hazardous material contamination.

11. **Population.** **No**

Candidate site development location, distribution or density of growth rate. The study is outside of any incorporated urban development boundary.

12. **Housing.** **No**

The candidate sites are in rural areas with no housing. There would be no housing demand created.

13. **Transportation/Circulation.** **Yes**

Passive recreational opportunities on any candidate site could increased traffic and require new parking where none existed before.

14. **Public Services.** **Maybe**

If candidate sites were to be developed, they could require maintenance for recreational and water ponding facilities.

15. **Energy.** **No**

Development of candidate sites would not require substantial amounts of fuel or energy.

16. **Utilities and Service Systems.** **Maybe**

If candidate sites were to be developed, they could require new utilities like power or natural gas. Regional storm water and groundwater recharge systems could be enhanced.

17. **Human Health.** **No**

No health hazards are anticipated with candidate site development.

18. **Aesthetics** **Maybe**

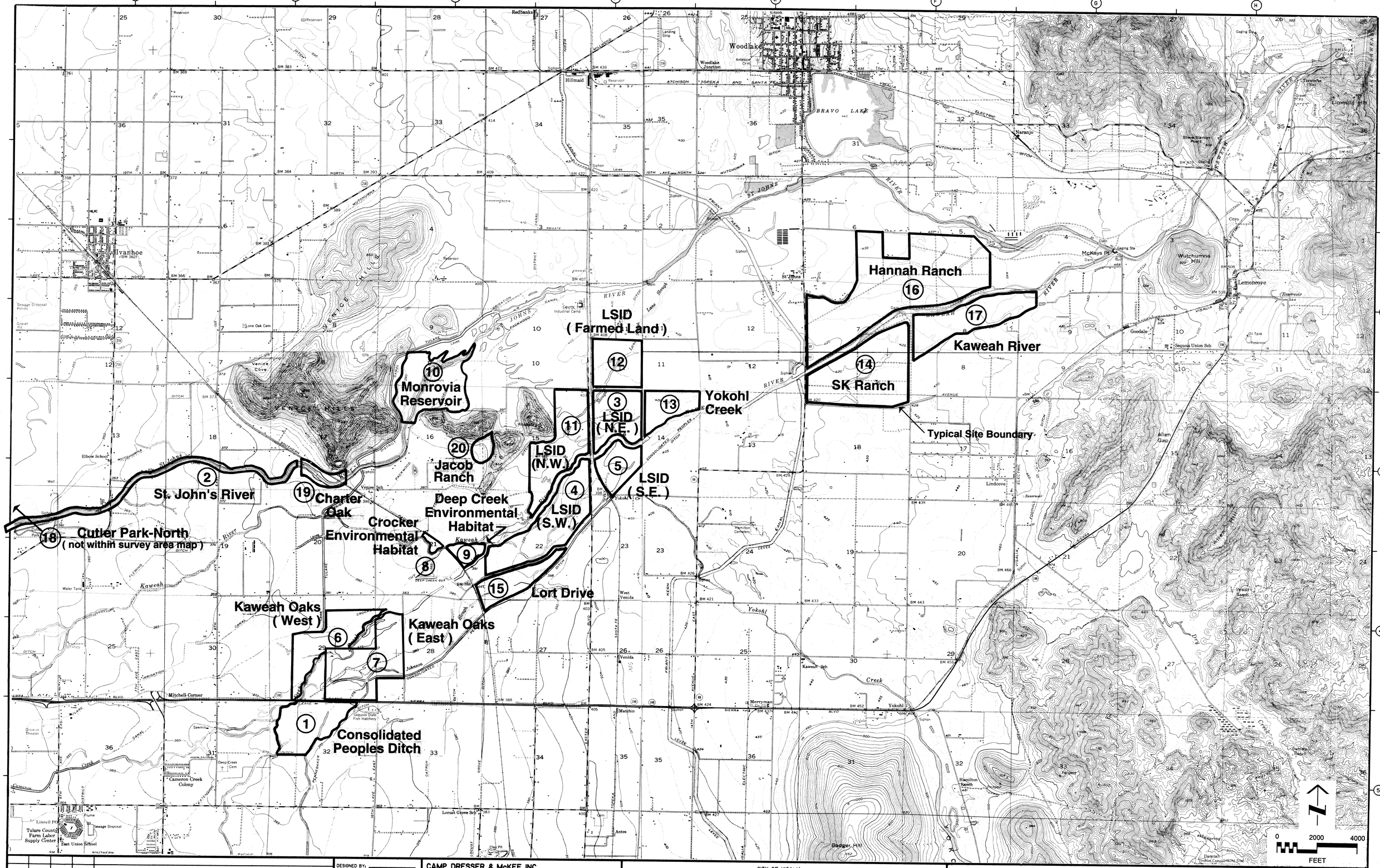
The potential exists for enhanced scenic views if any of the candidate sites were developed.

19. **Recreation.** **Maybe**

There would be no negative impacts to existing area recreation facilities. The potential exists for additional passive recreational opportunities should a candidate site be developed.

20. **Cultural Resources.** **Maybe**

Potential unrecorded archaeological sites may exist on all of the candidate sites because of the waterways that are adjacent to them. Contact with local Native American groups and on-site investigations should be required to determine if impacts could occur.



REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY:
DRAWN BY:
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE:

CAMP DRESSER & McKEE INC.
2150 River Plaza Drive
Suite 360
Sacramento, Ca. 95833
(916) 567-9900
environmental engineers, scientists, planners, & management consultants
CDM

CITY OF VISALIA
Exhibit A

KAWEAH RIVER DELTA CORRIDOR
ENHANCEMENT STUDY

Alternative Sites for Flood Control, Groundwater Recharge and Improved Wildlife Habitat

PROJECT NO.

SHEET NO.
Exhibit A